

UNIVERSITY of NEW ORLEANS

BID SPECIFICATIONS FOR
JOB ENTITLED

CHEMICAL SCIENCE ANNEX
OUTSIDE AIR UNIT REPLACEMENT

Sealed Bid #BTB 2664

Bid Date: SEPTEMBER 9, 2021

Bid Time: 2:00 p.m.

Mandatory Pre-Bid Conference:

Date: AUGUST 26, 2021

10:00 a.m. at the

Chemical Science Annex Building, Room 101



THE UNIVERSITY *of*
NEW ORLEANS

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PREPARED BY

UNIVERSITY OF NEW ORLEANS

PURCHASING OFFICE

Administration Annex, Room 1004-G

LAKEFRONT - NEW ORLEANS - LOUISIANA – 70148

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PURCHASING REPRESENTATIVE: Troy Bacino, Assistant Director
for Purchasing

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Date: July 21, 2021

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BID INFORMATION

UNIVERSITY of NEW ORLEANS

INSTRUCTIONS TO BIDDERS

ARTICLE I

PROJECT TITLE AND BID OPENING DATE & TIME

1.1 Project Title: **CHEMICAL SCIENCE ANNEX – OUTSIDE AIR UNIT REPLACEMENT**

Bid Opening Date & Time: **SEPTEMBER 9, 2021 at 2:00 p.m.**

Location of Bid Opening:

University of New Orleans Campus
Purchasing Office
Administration Annex, Room 1004G
New Orleans, Louisiana 70148

1.2 DEFINITIONS

1.2.1 The Bidding Documents include the following

- a. Bid Information & Forms dated 7/21/2021
- b. Specifications Sections 01000 through 16900 dated 7/16/2021.
- c. Drawings Sheets No. T-1, ME1 through ME6 dated 7/16/2021.
- d. Addenda issued during the bid period and acknowledged in the Bid Form

1.2.2 All definitions set forth in the General Conditions of the Contract for Construction, AIA Documents A201, or in other Contract Documents are applicable to the Bidding Documents.

1.2.3 Addenda are written or graphic instruments issued by the Architect prior to the opening of bids which modify or interpret the bidding documents by addition, deletions, clarifications, or corrections.

1.2.4 A Bid is a complete and properly signed proposal to do the Work or designated portion thereof for the sums stipulated therein supported by data called for by the Bidding Documents.

1.2.5 Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described as the base, to which work may be added for sums stated in Alternate Bids.

1.2.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to the amount of the Base Bid if the corresponding change in project scope or materials or methods of construction described in the Bidding Documents is accepted.

1.2.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials or services as described in the proposed Contract Documents.

1.2.8 A Bidder is one who submits a Bid for a prime contract with the Owner for the Work described in the proposed Contract Documents.

1.2.9 A Sub-bidder is one who submits a bid to a Bidder for materials or labor for a portion of the Work

ARTICLE 2

BIDDER'S REPRESENTATION

2.1 Each Bidder by making his bid represents that:

- 2.1.1 He has read and understands the Bidding Documents and his bid is made in accordance therewith.
- 2.1.2 He has visited the site and familiarized himself with the local conditions under which the work is to be performed.

The Bidder is advised to carefully consider all University physical features and activities and occupancies by faculty, staff and students, and to plan construction activities so as not to disrupt the normal operations and activities of the University except as expressly permitted by the University in writing. The Bidder shall be especially aware of existing electric, gas, water, telephone and/or other utilities and facilities which may be in the way of or adjacent to the Work, and shall take appropriate action to protect these utilities during the Work.

Every effort has been made to accurately show all pertinent surface and subsurface features accurately. For self-assurance, the Bidder may examine available drawings and documents related to University premises. Such examinations may be made only in the offices of the University Facility Services as part of the Mandatory Pre-Bid Conference.

- 2.1.3 His bid is based solely upon the materials, systems and equipment described in the Bidding Documents as advertised and as modified by addenda.
- 2.1.4 When a discrepancy or ambiguity arises between the written specifications and the drawings, the document which is more stringent, or which benefits the University more as determined by the Director, shall govern.
- 2.1.5 His bid is not based on any verbal instructions contrary to the Bidding Documents and addenda.
- 2.2 The Bidder must be fully qualified under any State or local licensing law for Contractors in effect at the time and at the location of the work before submitting his bid. In the State of Louisiana, only the bids of Contractors and Subcontractors duly licensed under Louisiana Revised Statutes 37:2150, et seq. will be considered, if applicable. The Contractor shall be responsible for determining that all of his Subbidders or prospective Subcontractors are duly licensed in accordance with law. (See paragraph 4.1.8)
- 2.3 The University reserves the right to examine the Successful Bidder's past payroll records and those of any subcontractor to determine whether the employees being used on the contract are regularly employed. The University also reserves the right to question the use of an employee whom it feels is unskilled or untrained on a task that requires a skill. If the bidder intends to use laborers or unskilled workmen on any aspect of the contract, the bidder must furnish a list of the tasks to be performed by said laborers and unskilled workmen with their bid.
- 2.4 If the Contractor is required to replace any employees because of their failure to comply with these requirements, any time lost on the job shall be the responsibility of the Contractor and shall not be an acceptable reason for requesting extensions of any completion deadlines or waiver of any liquidated damages specified elsewhere in the bid specifications.
- 2.5 In the event of inconsistencies within or between parts of the Contract Documents, or between the Contract Documents and applicable standards, codes, and ordinances, the Contractor shall: (1) Provide the better quality, upgrade, or quantity of Work, or (2) Comply

with the more stringent requirement, either or both in accordance with the Architect's interpretation.

ARTICLE 3

BIDDING DOCUMENTS

3.1 Copies

- 3.1.1 Complete bid documents may be obtained from the University of New Orleans Purchasing Office.

The Bidding Documents consist of the Drawings, the Bid Instructions and all Addenda issued prior to bid opening. Changes to the work made after the contract signing shall be documented by Change Order.

These INSTRUCTIONS TO BIDDERS, including amendments and additions thereto, apply to each and every heading of the TECHNICAL SPECIFICATIONS with the same force as though repeated in full under each heading.

- 3.1.2 Complete sets of Bidding Documents shall be used in preparing bids; neither the University nor the Consultant assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 3.1.3 The University or Consultant in making copies of the Bidding Documents available on the above terms, do so only for the purpose of obtaining bids on the work and do not confer a license or grant for any other use.

3.2 Interpretation or Correction of Bidding Documents

- 3.2.1 Bidders shall promptly notify the Architect of any ambiguity, inconsistency, or error which they may discover upon examination of the Bidding Documents or of the site and local conditions
- 3.2.2 Bidders requiring clarification or interpretation of the Bidding Documents shall make a written request to the Engineer, (**email jcrumb@crumbengineering.com**) to reach him at least seven (7) days prior to the date for receipt of bids.
- 3.2.3 It shall be the Bidder's responsibility to make inquiry as to addenda issued. All issued addenda shall be acknowledged on the Bid Form and shall become part of the Contract. Neither the University nor its Consultant(s) will be responsible for any explanation or interpretations of the Documents not covered by written, issued addenda.
- 3.2.4 Any interpretation, correction or change of the Bidding Documents will be made by addendum. Interpretations, corrections or changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections and changes.

3.3 Substitutions

- 3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. No substitutions shall be allowed after bid opening.

- 3.3.2 No substitution will be considered unless written request for approval has been submitted by the Proposer and has been received by the Architect at least seven (7) days prior to the date for receipt of bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including model numbers, drawings, cuts, performance and test data and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment or work that incorporation of the substitute would require shall be included. It shall be the responsibility of the proposer to include in his proposal all changes required of the Contract Documents if the proposed substitute is used. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

Approval, if granted, is given contingent upon Contractor being responsible for any costs which may be necessary to modify the space or facilities needed to accommodate the materials and equipment approved.

- 3.3.3 If the Architect approves any proposed substitution, such approval will be set forth in an addendum. Bidders shall not rely upon approvals made in any other manner.
- 3.3.4 It is incumbent upon the bidder, once a substitution is accepted, to assure that the substitution will meet the requirements of the project as an acceptable and contributing operating component of the completed project. The bidder and proposer of the substitution if used in the project shall provide all information, drawings and other necessary equipment, and coordination to ensure that the substitution will operate, fit and be able to be maintained as an acceptable operating component of the project.

3.4 Addenda

- 3.4.1 Addenda will be e-mailed or delivered to all Contractors in attendance at the mandatory Pre-Bid Conference or to all known bidders by the Purchasing Department of the University of New Orleans to have received a complete set of bidding documents if no mandatory Pre-Bid Conference is scheduled.
- 3.4.2 Copies of addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.
- 3.4.3 Addenda shall not be issued within a period of seventy-two (72) hours prior to the time set for the opening of bids, excluding Saturdays, Sundays, and any other legal holidays; however, if the necessity arises to issue an addendum modifying plans and specifications within the seventy-two-hour (72) period prior to the time for the opening of bids, then the opening of bids shall be extended exactly one week, without the requirement of re-advertising.
- 3.4.4 The University shall have the right to extend the bid date by up to (30) thirty days without the requirement of re-advertising. Any such extension shall be made by addendum issued by the University of New Orleans Purchasing Office.
- 3.4.5 Each Bidder shall ascertain from the University of New Orleans Purchasing Office prior to submitting his bid that he has received all addenda issued, and he shall acknowledge their receipt on the Bid Form.

ARTICLE 4

BIDDING PROCEDURE

4.1 Form and Style of Bids

- 4.1.1 Bids shall be submitted on the forms provided by the University.
- 4.1.2 All blanks on the Bid Form shall be filled in by electronic means, typewriter or manually in ink. Signature is required manually by ink.
- 4.1.3 Where so indicated by the makeup of the Bid Form, sums shall be expressed in both words and figures, and in case of discrepancy between the two, the written words shall govern.
- 4.1.4 Any interlineations, alteration or erasure must be initialed by the signer of the bid or his authorized representative.
- 4.1.5 Bidders are cautioned to complete all alternates and unit prices should such be required in the Bid Form. Failure to submit alternate and unit prices will render the proposal informal and shall cause its rejection.
- 4.1.6 Bidder shall make no additional stipulations on the Bid Form nor qualify his bid in any other manner.
- 4.1.7 The bid shall include the legal name of Bidder and the bid shall be signed by the person or persons legally authorized to bind the Bidder to a Contract. The authority of the signature of the person submitting the bid shall be deemed sufficient and acceptable under any of the following conditions:
 - a. Signature on bid is that of any corporate officer or member of a partnership or partnership in commendam listed on most current annual report on file with Secretary of State.
 - b. Signature on bid is that of authorized representative of corporation, partnership, or other legal entity and bid is accompanied by corporate resolution, certification as to the corporate principal, or other documents indicating authority which are acceptable to the University
 - c. Corporation, partnership, or other legal entity has filed in the records of the Secretary of State, an affidavit, resolution or other acknowledged or authentic document indicating the names of all parties authorized to submit bids for public contracts. A bid submitted by an agency shall have a current Power of Attorney attached certifying agent's authority to bind Bidder. The name and license number on the envelope shall be the same as the entity identified on the Bid Form

By signing this bid, the bidder certifies compliance with the above

- 4.1.8 On any bid of Ten Thousand Dollars (\$10,000.00) or more, the Contractor shall certify that he is licensed under R. S. 37: 2150-2173 by placing his signature on the appropriate blank on the Bid Form.

The contractor shall place his Louisiana Contractor License Number on the appropriate blank on the Bid Form.

The Contractor shall be licensed by the Louisiana State Licensing Board for Contractors under Category 10 Mechanical.

Bids in excess of Ten Thousand Dollars (\$10,000.00) received from contractors not licensed under the above classification will not be considered.

4.2 Bid Security

- 4.2.1 No bid shall be considered or accepted unless the bid is accompanied by bid security. Bid Security must accompany the bid in the sealed envelope. Bidders to attach a certified check, cashier's check, or University of New Orleans Bid Bond Form in the amount of five percent (5%) of the sum of the base bid and all alternates, as an evidence of good faith. Bidders are hereby notified that Bank Checks, Official Bank Checks or similar are not acceptable as bid security. Certified or cashier's checks to be drawn on a bank insured by the Federal Deposit Insurance Corporation in favor of The University of New Orleans or the bid bond shall be written by a surety or insurance company currently on the U.S. Department of the Treasury Financial Management Service list of approved bonding companies which is published annually in the Federal Register, or by a Louisiana-domiciled insurance company with at least an A- rating in the latest printing of the A.M. Best's Key Rating Guide to write individual bonds up to ten percent of policyholder's surplus as shown in the A.M. Best's Key Rating Guide. If the bid security for this project is a Bond, then such Bond shall be submitted on the Bid Bond Form included in the specifications. Any Bond submitted other than on this bond form shall cause the bid to be rejected.

Bid Security furnished by the Contractor shall guarantee that the Contractor will, if awarded the work according to the terms of his proposal, enter into the Contract and furnish Performance and Payment Bonds as required by these Bidding Documents, within ten (10) days after written notice that the instrument is ready for his signature.

Should the Bidder refuse to enter into such Contract or fail to furnish such bonds, the amount of the bid security shall be forfeited to the University as liquidated damages, not as penalty.

- 4.2.2 The University will have the right to retain the bid security of Bidders until either (a) the Contract has been executed and bonds have been furnished, or (b) the specified time has elapsed so that bids may be withdrawn, or (c) all bids have been rejected.

4.3 Submission of Bids

- 4.3.1 Bids shall be sealed in the envelope furnished with bid documents and will be received until the time specified and at the place specified in these bid documents. It shall be the specific responsibility of the Bidder to deliver his sealed bid to the University of New Orleans Purchasing Office at the appointed place and prior to the announced time for the opening of bids. Late delivery of a bid for any reason, including late delivery by United States Mail, or express delivery, shall disqualify the bid. The bid envelope shall be identified legibly on the outside with the following:

- a. Project Name and Owner
- b. Architect
- c. Date
- d. Name , Address, and license number of the Bidder.

If the bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "Bid Enclosed" on the face thereof. Such bids shall be sent by Registered or Certified Mail, Return Receipt Requested, addressed to: University of New Orleans, Purchasing Office, Administration Annex Building, Room 1004-G, New Orleans, Louisiana 70148. Bids sent by express delivery shall be delivered to: University of New Orleans, Purchasing Office, Administration Annex Building, Room 1004-G, Lakefront, New Orleans, Louisiana 70148.

- 4.3.2 Bids shall be deposited at the designated location prior to the time on the date for receipt of bids indicated in these Bid documents, or any extension thereof made by addendum. Bids received after the time and date for receipt of bids will be returned unopened.
- 4.3.3 Bidder shall assume full responsibility for timely delivery at location designated for receipt of bids.
- 4.3.4 Oral, telephonic, telegraphic, or faxed bids are invalid and shall not receive consideration.
- 4.3.5 The University shall not consider notations written on outside of bid envelope which have the effect of amending the bid. Written modifications enclosed in the bid envelope, and signed or initialed by the Contractor or his representative, shall be accepted.
- 4.36 The bid submission shall include the following documents:
 - a. Bid Form and *Unit Price Form if unit prices are included*.
 - b. Bid Security
 - c. Document authorizing execution of signature on Bid Form if not submitting as a sole proprietor.

4.4 Modification or Withdrawal of Bid

- 4.4.1 A bid may not be modified, withdrawn, or canceled by the Bidder for a period of thirty (30) calendar days for the period following the time and bid date designated for the receipt of bids, and Bidder so agrees in submitting his bid, except in accordance with R.S. 38:2214 which states, in part, "Bids containing patently obvious, unintentional, and substantial mechanical, clerical, or mathematical errors, or errors of unintentional omission of a substantial quantity of work, labor, material, or services made directly in the compilation of the bid, may be withdrawn by the contractor if clear and convincing sworn, written evidence of such errors is furnished to the University of New Orleans Purchasing Office within forty-eight hours of the bid opening excluding Saturdays, Sundays, and legal holidays. Such errors must be clearly shown by objective evidence drawn from inspection of the original work papers, documents, or materials used in the preparation of the bid sought to be withdrawn. If the University of New Orleans Purchasing Office determines that the error is a patently obvious mechanical, clerical, or mathematical error, or unintentional omission of a substantial quantity of work, labor, material, or services, as opposed to a judgment error, and the bid was submitted in good faith it shall accept the withdrawal and return the bid security to

the contractor."

- 4.4.2 Prior to the time and date designated for receipt of bids, bids submitted early may be modified or withdrawn by notice to the University of New Orleans Purchasing Office at the place and prior to the time designated for receipt of bids.
- 4.4.3 Withdrawn bids may be resubmitted up to the time designated for the receipt of bids provided that they are then fully in conformance with these Instructions to Bidders.
- 4.4.4 Bid Security shall be in an amount sufficient for the bid as modified or resubmitted.

ARTICLE 5

CONSIDERATION OF BIDS

5.1 Opening of Bids

- 5.1.1 The properly identified Bids received on time will be opened publicly and will be read aloud, and a tabulation abstract of the amounts of the base bids and alternates, if any, will be made available to Bidders.

5.2 Rejection of Bids

- 5.2.1 The University shall have the right to reject any or all bids and in particular to reject a bid not accompanied by any required bid security or data required by the Bidding Documents or a bid in any way incomplete or irregular. The provisions and requirements of the Instructions to Bidders, the Advertisement for bids, and those required on the bid form shall not be considered as informalities and shall not be waived.
- 5.2.2 The University reserves the right to reject any and all bids at its discretion.

5.3 Acceptance of Bid

- 5.3.1 It is the intent of the University, if any alternates are accepted, to accept them in the order in which they are listed in the Bid Form. Determination of the Low Bidder shall be on the basis of the sum of the base bid and the alternates accepted. However, the University shall reserve the right to accept alternates in any order which does not affect determination of the Low Bidder.
- 5.3.2 University of New Orleans upon receipt of bids, shall act within thirty calendar days of such receipt to award contract to the lowest responsible bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents is judged to be reasonable and does not exceed the funds available or reject all bids. However, University of New Orleans, by mutually written consent, may agree to extend the deadline of award by one or more extensions of thirty calendar days.

ARTICLE 6

PERFORMANCE AND PAYMENT BOND

6.1 Bond Required

6.1.1 The Contractor shall pay for and provide a Performance and Labor and Material Payment Bond in the full amount of the bid within ten (10) days after written notice from the University or its Consultant that the work has been awarded to him. Bond furnished shall be a statutory bond and no modification, omissions, additions in or to the terms of the contract, in the plans and specifications or in the manner and mode of payment shall in any manner diminish, enlarge, or otherwise modify the obligations of the bond. Surety bond shall be written by a surety or insurance company currently on the U.S. Department of the Treasury Financial Management Service list of approved bonding companies which is published annually in the Federal Register or by an insurance company that is either domiciled in Louisiana or owned by Louisiana residents and is licensed to write surety bonds. For any public works project, no surety or insurance company shall write a bond which is in excess of the amount indicated as approved by the U.S. Department of the Treasury Financial Management Service list; companies authorized by this paragraph who are not on the treasury list shall not write a bond when the penalty exceeds fifteen percent of its capital and surplus, such capital and surplus being the amount by which the company's assets exceed its liabilities as reflected by the most recent financial statements filed by the company with the Department of Insurance. In addition, any surety bond written for a public works project shall be written by a surety or insurance company that is currently licensed to do business in the State of Louisiana. Bond shall be in favor of The University of New Orleans.

6.2 Time of Delivery and Form of Bond

- 6.2.1 The Bidder shall deliver the required bond to the University simultaneous with the execution of the Contract.
- 6.2.2 Bond shall be in the form furnished by University of New Orleans Purchasing Office, entitled CONTRACT BETWEEN OWNER AND CONTRACTOR AND PERFORMANCE AND PAYMENT BOND, a copy of which is included in the Contract Documents.
- 6.2.3 The Bidder shall require the Attorney-in-Fact who executes the required bond on behalf of the surety to affix thereto a certified and current copy of his power of Attorney.

ARTICLE 7

FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

7.1 Form to be Used

7.1.1 Form of the Contract to be used shall be furnished by the University of New Orleans Purchasing Office, a copy of which is bound in the Bidding Documents.

7.2 Post Bid Information & Award

7.2.1 Submissions: Within ten (10) days after the Bid, the following documents shall be

submitted to the Owner. **Failure to submit these documents within the specified time frame will result in disqualification of the Bidder.**

- a. Attestation Affidavit (Past Criminal Convictions of Bidders and Verification of Employees) form found within this bid package, in accordance with La. R.S. 38:2227 and LA. R.S. 38:2212.10.
- b. Non-Collusion Affidavit form bound within this bid package, in accordance with La. R.S. 38:2224

7.2.2 The Bidder shall, prior to the award of a Contract for the Work, submit the following information to the Architect.

- a. A designation of the work to be performed by the Bidder with his own forces.
- b. The proprietary names and the suppliers of principal items or systems of material and equipment proposed for the work.
- c. A list of names of the subcontractors or other persons or organizations (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the work.
- d. A Schedule of Values set up by trade item with labor and material separated for each phase of work.
- e. The name of the proposed superintendent along with a resume of same. The resume shall cover biographical data, past experience, and references.

7.2.3 The Bidder will be required to establish to the satisfaction of the Architect and the Owner the reliability and responsibility of the proposed Subcontractors to furnish and perform the work described in the Sections of the Specifications pertaining to such proposed Subcontractors' respective trades.

7.2.4 Prior to the award of the Contract, the Architect will notify the Bidder if either the Owner or the Architect, after due investigation, has reasonable and substantial objection to any person or organization on the Contractor's list of proposed Subcontractors.

7.2.5 Subcontractors and other persons and organizations proposed by the Bidder and accepted by the Owner and the Architect must be used on the work for which they were proposed and accepted and shall not be changed except with the written approval of the Owner and the Architect.

7.2.6 As soon as the contract has been fully awarded according to law, certified checks will be returned to all bidders other than the successful Bidder; the latter's check will be returned on the signing of the Contract.

7.2.7 Upon the execution of the contract, University of New Orleans, within thirty days thereafter, shall issue to the contractor a Notice to Proceed with the project. However, upon mutual consent by both parties, the Notice to Proceed may be extended.

7.2.8 After the purchase order has been awarded, no changes will be made to any part without written approval from the Director of the Department issuing these bid documents. The proposed change will be submitted in writing, with a complete breakdown of all material and labor, and the individual cost of each.

7.3 Successful Bidder's Delivery Schedule

- 7.3.1 The Successful Bidder will provide a delivery construction schedule. Submit within fifteen (15) days after the date established "Commencement of the Work".
- 7.3.2 Schedule Updating: Revise the schedule after each meeting, event, or activity where schedule revisions have been recognized or made. Distribute updated schedule with in seventy-two (72) hours to Project Manager for review.

7.4 Affirmative Action/Non-Discrimination

- 7.4.1 If the amount of the Contract is over \$10,000, the successful Bidder shall be required to execute the Equal Employment Opportunity Clause and Assurance of non-discrimination prior to the University entering into a contract. These documents will be in accordance with Chapter 60 of the rules and regulations, Office of Federal Contract Compliance, Equal Opportunity, U.S. Department of Labor.

7.5 Compliance Agreement

- 7.5.1 If the amount of the contract is \$50,000 or more, the successful Bidder shall be required to execute the Affirmative Action Compliance agreement prior to the University entering into a contract.

7.6 Recording Contract

- 7.6.1 The Contractor at his own expense, shall record the original executed Contract and the Performance and Labor and Material Bond with the Recorder of Mortgages, Orleans Parish, within five (5) working days of Contract signing. A NOTICE OF THIS RECORDING SHALL BE SENT TO THE PURCHASING OFFICE BEFORE PURCHASE ORDER AND NOTICE TO PROCEED ARE ISSUED.
- 7.6.2 Recordation of certain Change Orders, see General Conditions 1.16 CHANGES TO THE WORK.

7.7 Payments

- 7.7.1 The Contract shall provide payment equal to not more than ninety per cent (90%) of the total contract amount upon completion of the work. The remaining ten per cent (10%) shall be paid forty-five (45) days after the acceptance of the work by the University, provided a clear lien certificate is provided by the Contractor.
- 7.7.2 University standard forms for "Schedule of Values" and "Payment Request" will be provided to the Contractor at the Pre-Construction Conference. An original invoice must accompany the UNO pay request forms. **ONLY PAYMENT REQUESTS SUBMITTED ON THE UNIVERSITY FORM WILL BE PROCESSED FOR PAYMENT. ALL OTHERS WILL BE RETURNED FOR COMPLIANCE TO THIS REQUIREMENT.**
- 7.7.3 When an engineer, designer, or architect is involved with the project, all pay requests must have his or her original signature on the original pay request forms **before** they are submitted to the University for processing.

7.7.4 No notice of completion, delivery memo, invoice, or other document will be signed, or approvals of any type given for any part of the job or delivery of any equipment or materials, except by the Director of the Department issuing these bidding documents, or his designee, such designation to be made in writing and signed by the Director. All work will be done during normal working hours unless the Director grants prior written approval, or the scope of Work requires that the work be done after hours.

7.8 Termination of Contract for Convenience

7.8.1 The University may, at any time, terminate the Contract for the University's convenience and without cause. Upon receipt of written notice from the University of such termination for the University's convenience, the Contractor shall: cease operations as directed by the University in the notice; take actions necessary, or that the University may direct, for the protection and preservation of the Material, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

7.8.2 In case of such termination for the University's convenience, Contractor shall be entitled to receive payment for Work executed along with reasonable overhead and profit.

7.8.3 University shall not be responsible or otherwise liable for any demobilization costs or Incidental or consequential damages resulting from such termination.

7.9 Acceptance of the Work

7.9.1 Upon substantial completion of the Work, the University shall execute a certificate that the whole work provided for in this agreement has been completed and approved under the terms and conditions thereof.

The Contractor shall then file the acceptance of the whole work at his expense with the Recorder of Mortgage of the Parish of Orleans.

ARTICLE 8

COMPLETION TIME AND LIQUIDATED DAMAGES

8.1 Contract Time:

8.1.1 The Bidder agrees to guarantee completion of the work within **One Hundred and Eighty (180)** calendar days starting from the Notice to Proceed, subject to extensions as may be granted or the Contractor will be subject to pay to the University liquidated damages in the amount stated on this document. The Bidder's attention is especially directed to the urgency of this work and that time is of the essence.

- a. Extensions for weather conditions shall not be given unless weather conditions prevailing are deemed by the Architect to be abnormal.

8.2 Liquidated Damages

8.2.1 Time is of the essence and completion of the work must be within the Contract

Time for Completion-stated in Paragraph 8.1.1, subject to such extensions as may be granted by the University for delays identified as beyond the Contractor's control.

The Contractor will be assessed **Three Hundred Dollars (\$300.00)** for each consecutive calendar day during which the work remains incomplete beyond the Contract Completion date stated on the "Notice to Proceed" or as amended by Change order, Sundays and holidays included. This amount is agreed upon as the proper measure of liquidated damages which the University will sustain per day by the failure of the undersigned to complete the work at the stipulated time and is not to be construed in any sense as a penalty.

ARTICLE 9

PRE-BID CONFERENCE

- 9.1 A Mandatory Pre-Bid Conference shall be held at the project site. Provisions for the site inspection are included as part of the mandatory **Pre-Bid Conference to be held in Computer Science Annex Building, Room 101 at 10:00 A.M. on August 26, 2021.** The Pre-Bid Conference shall also provide opportunity for a review of the Bid Documents. The purpose of the Pre-Bid Conference is to familiarize Bidders with the requirements of the Project and the intent of the Bidding Documents, and to receive comments and information from interested Bidders.
- 9.2 Any revision of the Bidding Documents made as a result of the Pre-Bid Conference shall not be valid unless included in an addendum issued in accordance with Paragraph 3.4.1 of the Instructions to Bidders.

ARTICLE 10

FEDERAL & STATE CLAUSES FOR CONTRACTS

- 10.1 Federal clauses, if applicable
- 10.1.1 Anti-Kickback Clause: The contractor hereby agrees to adhere to the mandate dictated by the Copeland "Anti-Kickback" Act which provides that each contractor or subgrantee shall be prohibited from inducing, by any means, any person employed in the completion of work, to give up any part of the compensation to which he is otherwise entitled.
- 10.1.2 Clean Air Act: For contracts over \$150,000, the contractor hereby agrees to adhere to the provisions which require compliance with all applicable standards, orders or requirements issued under Section 306 of the Clean Air Act which prohibits the use under non-exempt federal contracts, grants or loans of facilities included on the EPA list of violating facilities.
- 10.1.3 Energy Policy and Conservation Act: The contractor hereby recognizes the mandatory standards and policies relating to energy efficiency which are contained in the State energy conservation plan issued in compliance with the Energy Policy and Conservation Act (P.L. 94-163).
- 10.1.4 Clean Water Act: For contracts over \$150,000, the contractor hereby agrees to adhere to the provisions which require compliance with all applicable standards, orders or requirements issued under Section 508 of the Clean Water Act which

prohibits the use under non-exempt federal contracts, grants or loans of facilities included on the EPA list of violating facilities.

10.1.5 Anti-Lobbying and Debarment Act: The contractor will be expected to comply with federal statutes in the Anti-Lobbying Act and the Debarment Act.

10.2 Prohibition of discriminatory boycotts of Israel in accordance with LA R.S. 39:1602.1 , the following applies to any bid with a value of \$100,000 or more and to vendors with five or more employees: by submitting a response to this solicitation, the bidder or proposer certifies and agrees that the following information is correct: in preparing its response, the bidder or proposer has considered all proposals submitted from qualified, potential subcontractors and suppliers, and has not, in the solicitation, selection, or commercial treatment of any subcontractor or supplier, refused to transact or terminated business activities, or taken other actions intended to limit commercial relations, with a person or entity that is engaging in commercial transactions in Israel or Israel-controlled territories, with the specific intent to accomplish a boycott or divestment of Israel. The bidder has also not retaliated against any person or other entity for reporting such refusal, termination, or commercially limiting actions. The state reserves the right to reject the response of the bidder or proposer if this certification is subsequently determined to be false, and to terminate any contract awarded based on such a false response.

10.3 Certification of no federal suspension or debarment: By signing and submitting any bid for \$25,000 or more, the bidder certifies that their company, any subcontractors, or principals are not suspended or debarred by the General Services Administration (GSA) in accordance with the requirements in "audit requirements in subpart F of the Office of Management and Budget's Uniform Administrative Requirements, Cost Principles, and Audit Requirements for federal awards" (formerly OMB Circular A-133).

A list of parties who have been suspended or debarred can be viewed via the internet at <https://www.sam.gov>.

10.4 In accordance with Louisiana law, all corporations (see LA R.S. 12:262.1) and limited liability companies (see LA R.S. 12:1308.2) must be registered and in good standing with the Louisiana Secretary of State in order to hold a purchase order and/or contract over \$25,000.

ARTICLE 11

INSURANCE

10.1 The Contractor, prior to commencing work, shall provide at his expense, proof of insurance coverage with insurance companies licensed in the State of Louisiana. Insurance shall be placed with insurers with an A.M. Best's rating of no less than A-:VI.

10.2 Insurance requirements are set forth in "Supplement I" of these documents.

SUPPLEMENT I
INSURANCE REQUIREMENTS

***** INSURANCE *****

STANDARDIZED INSURANCE REQUIREMENTS FOR ALL AGENCY CONTRACTS

- I. The following Indemnification Agreement shall be, and is hereby, a provision of the contract:

The other party agrees to protect, defend, indemnify, save and hold harmless the State of Louisiana, all State Departments, Agencies, Boards and Commissions, its officers, agents, servants and employees, including volunteers, from and against any and all claims, demands, expense and liability arising out of injury or death to any person or the damage, loss or destruction of any property which may occur or in any way grow out of any act or omission of the other party, its agents, servants, and employees, or any and all costs, expense and/or attorney fees incurred by the other party as a result of any claim, demands, and/or causes of action except of those claims, demands, and/or causes of action arising out of the negligence of the State of Louisiana, all State Departments, Agencies, Boards, Commissions, its agents, representatives, and/or employees. The other party agrees to investigate, handle, respond to, provide defense for and defend any such claims, demand, or suit at its sole expense and agrees to bear all other costs and expenses related thereto, even if it (claims, etc.) is groundless, false or fraudulent.

- II. All policies and certificates of insurance of the Contractor/Subcontractor shall contain the following clauses:
- A. The Contractor/Subcontractor's insurer will have no right of recovery or subrogation against the Agency, it being the intention of the parties that the insurance policies so affected shall protect both parties and the primary coverage for any and all losses covered by the below described insurance.
- B. The Agency shall be named as an additional insured as regards negligence by the contractor (ISO Form CG 20 10 – current form approved for use in Louisiana).
- C. The insurance companies issuing the policy or policies shall have no recourse against the Agency for payment of any premiums or for assessments under any form of policy.
- D. Any and all deductibles in the below described insurance policies shall be assumed by and be for the amount of, and at the sole risk of the Contractor/Subcontractor.
- III. **INSURANCE:** The Contractor/Subcontractor, prior to commencing work, shall provide at his own expense, proof of the following insurance coverages required by the contract to the Agency in insurance companies authorized in the State of Louisiana. Insurance is to be placed with insurers with an A. M. Best's rating of **A-:VI or higher**. This rating requirement may be waived for workers' compensation coverage only.

Thirty days prior notice of cancellation shall be given to the Agency by registered mail, return receipt requested, on all of the required coverage provided to the Agency. All notices will name the Contractor/Subcontractor and identify the contract number.

Insurance coverage specified in the GENERAL CONDITIONS (AIA Document A 201, 1997 Edition) to be provided by the Contractor, and any other insurance described below shall be furnished with the following minimum limits:

**SUPPLEMENT I
INSURANCE REQUIREMENTS**

***** INSURANCE *****

- A. Workers' Compensation - Statutory - in compliance with the Compensation Law of the State. Exception: Employers liability to be \$1,000,000 when work is to be over water and involves maritime exposures.
- B. Commercial General Liability Insurance with a combined single limit per occurrence for bodily injury and property damage. This insurance shall include coverage for bodily injury and property damage, and include the following coverages:
1. Premises - Operations;
 2. Broad Form Contractual Liability;
 3. Products and Completed Operations;
 4. Use of Contractors and Subcontractors;
 5. Personal Injury;
 6. Broad Form Property Damage;
 7. Explosion, Collapse and Underground (XCU) Coverage.

NOTE: On the certificate of insurance, under the description of operations, the following wording is required: THE AGGREGATE LOSS LIMIT APPLIES TO EACH PROJECT, or a copy of ISO form CG 25-03 (current form approved for use in Louisiana) shall be submitted.

COMBINED SINGLE LIMIT (CSL) - AMOUNT OF INSURANCE REQUIRED

Type of <u>Construction</u>	Projects under <u>\$100,000</u>	Projects \$100,001 <u>up to \$1,000,000</u>	Projects over <u>\$1,000,000</u>
New Buildings:			
Each Occurrence/ Minimum Limit	\$500,000	\$1,000,000	\$3,000,000
Aggregate (Applicable to this contract ONLY)	\$500,000	\$1,000,000	\$3,000,000
Renovations:			
	<u>The building(s) value for this project is : \$16,116,667.00</u>		
Each Occurrence/ Minimum Limit	\$500,000**	\$1,000,000**	\$3,000,000**
Aggregate (Applicable to this contract ONLY)	\$500,000**	\$1,000,000**	\$3,000,000**

While the minimum combined single limit of \$500,000 is required for all renovations, the value of a building shall be multiplied by 10% and insurance requirements will be increased at \$1,000,000 intervals and rounded to the nearest \$1,000,000. Example: Renovation on \$33,000,000 building would require \$3,000,000 minimum combined single limit of coverage. Maximum limit required is \$5,000,000 regardless of building value.

- C. Business Automobile Liability Insurance with a combined single limit of \$1,000,000 per occurrence for bodily injury and property damage, unless otherwise indicated. This insurance shall include for bodily injury and property damage the following coverages:

**SUPPLEMENT I
INSURANCE REQUIREMENTS**

***** INSURANCE *****

1. Owned automobiles;
2. Hired automobiles;
3. Non-owned automobiles.

D. An Umbrella Policy may be used to meet minimum requirements.

IV. All property losses shall be made payable to and adjusted with the Agency.

V. All policies of insurance shall be approved by the contracting Agency prior to the inception of any work.

VI. Other insurance required is as follows:

Owner's Protective Liability (OPL) Insurance shall be furnished by the Contractor and naming the State of Louisiana as the Named Insured for projects over \$50,000.

	Projects under <u>\$100,000</u>	Projects \$100,001 <u>up to \$1,000,000</u>	Projects over <u>\$1,000,000</u>
CSL – Each Occurrence:	\$500,000	\$1,000,000	\$3,000,000

VII. Property Insurance

The General Contractor shall purchase and maintain property insurance upon the entire work included in the contract for an amount equal to the greater of the full-completed value or the amount of the construction contract including any amendments thereto. The general contractor's policy shall provide "ALL RISK" Builder's Risk insurance (Extended to include the perils of wind, collapse, vandalism/malicious mischief, and theft, including theft of materials whether or not attached to any structure). The "All Risk" Builder's Risk insurance must also cover architect's and engineer's fees that may be necessary to provide plans and specifications and supervision of work for the repair and/or replacement of property damage caused by a covered peril not to exceed 10% of the cost of those repair and/or replacements

Flood coverage shall be provided by the Contractor on the first floor and below for projects North of the Interstate Corridor beginning at the Texas – Louisiana border at Interstate 10 east to the Baton Rouge junction of Interstate 12, East to Slidell junction with Interstate 10 to the Louisiana – Mississippi border. Flood sub-limit shall equal an amount no lower than 10% of the total contract cost per occurrence. Coverage for roofing projects shall not require flood coverage.

On projects south of this corridor, flood coverage shall be provided by the State of Louisiana, as the owner, through the National Flood Insurance Program (NFIP). The Contractor will be liable for the \$5,000 deductible on the NFIP policy from the Notice to Proceed date through the Notice of Final Acceptance date of the project.

A specialty contractor shall purchase and maintain property insurance upon the system to be installed for an amount equal to the greater of the full-completed value or the amount of the contract including any amendments thereto. The specialty contractor may provide an installation floater with the same coverage as the "ALL RISK" Builder's Risk insurance policy.

SUPPLEMENT I
INSURANCE REQUIREMENTS

***** INSURANCE *****

The policy must include the interest of the Owner, Contractor, and Subcontractors as their interest may appear. The contractor has the right to purchase coverage or self-insure any exposures not required by the bid specifications, but shall be held liable for all losses, deductibles, self-insurance for coverage not required.

Policies insuring projects involving additions, alterations or repairs to existing buildings or structures must include an endorsement providing the following:

In the event of a disagreement regarding a loss covered by this policy which may also be covered by the State of Louisiana, Policy of self-insurance or any commercial property insurance policy purchased by the State of Louisiana, Office of Risk Management (ORM) covering in excess of the State of Louisiana, policy of self-insurance, this company agrees to the following procedure to establish coverage and/or the amount of loss:

Any party to a loss may make a written demand for an appraisal of the matter in disagreement. Within 20 days of receipt of written demand, this company and either ORM or its commercial insurance company shall each select a competent and impartial appraiser and notify the other of the appraiser selected. The two appraisers will select a competent and impartial umpire. The appraisers will then identify the policy or policies under which the loss is insured and, if necessary, state separately the value of the property and the amount of loss that must be borne by each policy. If the appraisers fail to agree, they shall submit their differences to the umpire. A written decision by any two shall determine the policy or policies and the amount of loss. Each insurance company (or ORM) agree that the decision of the appraisers and the umpire, if involved, will be binding and final and that neither party will resort to litigation. Each of the two parties shall pay its chosen appraiser and bear the cost of the umpire equally.

VIII. If, at any time, any of the said policies shall be or become unsatisfactory to the Agency, as to form or substance, or if a company issuing any such policy shall be or become unsatisfactory to the Agency, the Contractor/Subcontractor shall promptly obtain a new policy, submit the same to the Agency for approval and submit a certificate thereof as herein above provided.

Upon failure of the Contractor/Subcontractor to furnish, deliver and maintain such insurance as above provided, this contract, at the election of the Agency, may be forthwith declared suspended, discontinued or terminated. Failure of the Contractor/Subcontractor to take out and/or to maintain or the taking out and/or maintenance of any required insurance shall not relieve the Contractor/Subcontractor from any liability under the contract, nor shall the insurance requirements be construed to conflict with the obligations of the Contractor/Subcontractor concerning indemnification. The Agency reserves the right to require complete, certified copies of all required insurance policies at any time.

**SUPPLEMENT I
INSURANCE REQUIREMENTS**

***** INSURANCE *****

INFORMATION FOR BIDDERS

RISKS AND INDEMNIFICATIONS ASSUMED BY THE CONTRACTOR

- A. Neither the acceptance of the completed work or payment therefore shall release the Contractor/Subcontractor from his obligations from the insurance requirements or indemnification agreement.
1. Additional insurance may be required on an individual basis for extra hazardous contracts and specific service agreements. If such additional insurance is required for a specific contract, that requirement will be described in the "Special Conditions" of the contract specifications.
 2. If any of the Property and Casualty insurance requirements are not complied with at their renewal dates, payments to the Contractor/Subcontractor will be withheld until those requirements have been met, or at the option of the Agency, the Agency may pay the Renewal Premium and withhold such payments from any monies due the Contractor/Subcontractor.
 3. All property losses shall be made payable to and adjusted with the Agency.
 4. All policies and certificates of insurance shall be approved by the contracting agency prior to the inception of any work.
 5. Other coverages may be required by the Agency based on specific needs. If such other coverages are required for this contract, those coverages will be described in the "Special Conditions" of the contract specifications.
 6. If at any time any of the foregoing policies shall be or become unsatisfactory to the Agency, as to form or substance, or if a company issuing any such policy shall be or become unsatisfactory to the Agency, the Contractor/Subcontractor shall, upon notice to that effect from the Agency, promptly obtain a new policy, submit the same to the Agency for approval and submit a certificate thereof as herein above provided. Upon failure of the Contractor/Subcontractor to furnish, deliver and maintain such insurance as above provided, this Contract, at the election of the Agency, may be forthwith declared suspended, discontinued or terminated. Failure of the Contractor/Subcontractor to take out and/or maintain or the taking out and/or maintenance of any required insurance, shall not relieve the Contractor/Subcontractor from any liability under the Contract, nor shall the insurance requirements be construed to conflict with or otherwise limit the obligations of the Contractor/Subcontractor concerning indemnification. The agency reserves the right to require complete, certified copies of all required insurance policies at any time.

SUBCONTRACTORS

Contractor shall include all subcontractors as insured's under its policies or shall furnish separate certificates for each subcontractor. All coverages for subcontractors shall be subject to all of the requirements stated herein.

CERTIFICATES OF INSURANCE

Contractor shall furnish the Agency with certificates of insurance affecting coverage required by this clause. The certificates for each insurance policy are to be signed by a person authorized by that

SUPPLEMENT I
INSURANCE REQUIREMENTS

***** INSURANCE *****

insurer to bind coverage on its behalf. The certificates are to be received and approved by the Agency before work commences. The Agency reserves the right to require complete, certified copies of all required insurance policies at any time.

INSURANCE REQUIREMENTS FOR CONTRACTORS

Contractor shall procure and maintain for the duration of the contract insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees or subcontractors. The cost of such insurance shall be included in the Contractor's bid.

A. MINIMUM SCOPE OF INSURANCE

Coverage shall be at least as broad as:

1. Insurance Services Office Commercial General Liability coverage "occurrence" form CG 00 01 (current form approved for use in Louisiana). "Claims Made" form is unacceptable.
2. Insurance Services Office form number CA 00 01 (current form approved for use in Louisiana) covering Automobile Liability. The policy shall provide coverage for owned, hired, and non-owned coverage. If an automobile is to be utilized in the execution of this contract, and the vendor/contractor does not own a vehicle, then proof of hired and non-owned coverage is sufficient.
3. Workers' Compensation insurance as required by the Labor Code of the State of Louisiana, including Employers Liability insurance.

B. MINIMUM LIMITS OF INSURANCE

Contractor shall maintain limits no less than:

1. Commercial General Liability: \$1,000,000 combined single limit per occurrence for bodily injury, personal injury and property damage (or higher limits depending on size of contract.)
2. Automobile Liability: \$1,000,000 combined single limit per accident, for bodily injury and property damage.
3. Workers Compensation and Employers Liability: Workers' Compensation limits as required by the Labor Code of the State of Louisiana and Employers Liability coverage. Exception: Employers liability limit is to be \$1,000,000 when work is to be over water and involves maritime exposure.

C. DEDUCTIBLES AND SELF-INSURED RETENTIONS

Any deductibles or self-insured retentions must be declared to and approved by the Agency. At the option of the Agency, either 1) the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the Agency, its officers, officials, employees and volunteers, or 2) the Contractor shall procure a bond guaranteeing payment of losses and related investigations, claim administration and defense expenses.

SUPPLEMENT I
INSURANCE REQUIREMENTS

***** INSURANCE *****

D. OTHER INSURANCE PROVISIONS

The policies are to contain, or be endorsed to contain, the following provisions:

1. General Liability and Automobile Liability Coverages

- a. The Agency, its officers, officials, employees, Boards and Commissions and volunteers are to be added as "additional insured" as respects liability arising out of activities performed by or on behalf of the Contractor; products and completed operations of the Contractor, premises owned, occupied or used by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to the Agency, its officers, officials, employees or volunteers. It is understood that the business auto policy under "Who is an Insured" automatically provides liability coverage in favor of the State of Louisiana.
- b. Any failure to comply with reporting provisions of the policy shall not affect coverage provided to the Agency, its officers, officials, employees, Boards and Commissions or volunteers.
- c. The Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

2. Workers' Compensation and Employers' Liability Coverage

The insurer shall agree to waive all rights of subrogation against the Agency, its officers, officials, employees and volunteers for losses arising from work performed by the Contractor for the Agency.

3. All Coverages

Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, canceled by either party, reduced in coverage or in limits except after thirty (30) days' prior written notice by certified mail, return receipt requested, has been given to the Agency.

E. ACCEPTABILITY OF INSURERS

Insurance is to be placed with insurers with an A.M. Best's rating of **A-:VI or higher**. This rating requirement may be waived for workers' compensation coverage only.

F. VERIFICATION OF COVERAGE

Contractor shall furnish the Agency with certificates of insurance effecting coverage required. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf. The certificates are to be received and approved by the Agency before work commences. The Agency reserves the right to require complete, certified copies of all required insurance policies at any time.

***** INSURANCE AND INDEMNIFICATION *****

**** EXHIBIT A ****

INDEMNIFICATION AGREEMENT

The _____ agrees to protect, defend, indemnify, save, and hold harmless the
{Contractor/Subcontractor/Lessee/Supplier}

State of Louisiana, all State Departments, Agencies, Boards and Commissions, its officers, agents, servants and employees, including volunteers, from and against any and all claims, demands, expenses and liability arising out of injury or death to any person or the damage, loss or destruction of any property which may occur or in any way grow out of any act or omission of _____, its agents, servants, and
{Contractor/Subcontractor/Lessee/Supplier}

employees, or any and all costs, expenses and/or attorney fees incurred by

_____ as a result of any claims, demands, and/or causes of action except
{Contractor/Subcontractor/Lessee/Supplier}

those claims, demands, and/or causes of action arising out of the negligence of the State of Louisiana, all State Departments, Agencies, Boards, Commissions, its agents, representatives, and/or employees.

_____ agrees to investigate, handle, respond to, provide defense for and
{Contractor/Subcontractor/Lessee/Supplier}

defend any such claims, demands, or suits at its sole expense and agrees to bear all other costs and expenses related thereto, even if they (claims, etc.) are groundless, false or fraudulent.

Accepted by _____
Company Name

Signature

Title

Date Accepted _____

Is Certificate of Insurance Attached? _____ Yes _____ No

Contract No. _____ for _____
State Agency Number and Name

PURPOSE OF CONTRACT: _____

BID BOND

FOR

UNIVERSITY OF NEW ORLEANS PROJECT

(Date)

KNOW ALL MEN BY THESE PRESENTS:

That _____ of

_____, as Principal, and

_____, as Surety, are held and firmly bound unto the State of Louisiana, and The University of New Orleans, in the full and just sum of five (5%) percent of the total amount of this proposal, including all alternates, lawful money of the United States, for payment of which sum, well and truly be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally firmly by these presents.

Surety represents that it is listed on the current U.S. Department of the Treasury Financial Management Service list of approved bonding companies as approved for an amount equal to or greater than the amount for which it obligates itself in this instrument or that it is a Louisiana-domiciled insurance company with at least an A- rating in the latest printing of the A.M. Best's Key Rating Guide. If surety qualifies by virtue of its Best's listing, the Bond amount may not exceed ten percent of policyholders' surplus as shown in the latest A.M. Best's Key Rating Guide.

The Surety further represents that it is licensed to do business in the State of Louisiana and that this Bond is signed by surety's agent or attorney-in-fact. This Bid Bond is accompanied by appropriate power of attorney.

THE CONDITION OF THIS OBLIGATION IS SUCH that, whereas said Principal is herewith submitting its proposal to the obligee on a Contract for:

NOW, THEREFORE, if the said Contract be awarded to the Principal and the Principal shall, within such time as may be specified, enter into the Contract in writing and give a good and sufficient bond to secure the performance of the terms and conditions of the Contract with surety acceptable to the obligee, then this obligation shall be void; otherwise this obligation shall become due and payable.

PRINCIPAL (BIDDER)

SURETY

BY _____ BY _____

AUTHORIZED OFFICER-OWNER-PARTNER

AGENT OR ATTORNEY-IN-FACT

(SEAL)

CONTRACT BETWEEN UNIVERSITY AND CONTRACTOR

This agreement made and entered into at New Orleans, Louisiana, this ____ day of _____, 200__, by and between The University of New Orleans, herein represented by Troy A. Bacino, Assistant Director of Purchasing, University of New Orleans, party of the first part and hereinafter sometimes called the

University; and _____
(Contractor)

herein represented by _____
(Name and title)

Party of the second part and hereinafter sometimes called the Contractor:

WITNESSETH, THAT the University and the Contractor, for the considerations hereinafter named, agree as follows, that:

1. The Advertisement for Bids (if advertised)
2. The Bid Proposal
3. The General Conditions and Instructions
4. Bonds
5. The Specifications
6. The Following Enumerated Plans:
7. The Following Enumerated Addenda:

are all hereby made a part of this Contract to the same extent as if incorporated here in full.

CONTRACT BETWEEN UNIVERSITY AND CONTRACTOR

The Contractor agrees to furnish all materials, labor, tools, equipment and other facilities necessary and to perform all work required for:

In accordance with this Contract and their proposal dated _____ all in strict accord with the requirements of the Contract.

The work to be performed under this contract shall be commenced immediately after award is made to the successful bidder and notification by the University that the work shall start, and shall be fully completed within the time stated in the Instructions to Bidders, subject to pertinent provisions of the General Conditions of the Contract Documents.

The amount to be paid to the Contractor by the University, subject to modification on account of changes as herein provided and/or as may be agreed to in writing by both parties to this contract

is _____

(figures)

(in words)

The University shall make payments on account of the Contract as provided in the Instructions and Specifications.

Performance and Payment Bond: To these presents personally came and intervened, herein acting for _____, a corporation organized and existing under the laws of the State of _____, and duly authorized to transact business in the state of Louisiana, as surety, who declared that having taken cognizance of this Contract and of the Construction Documents mentioned herein, he hereby in his capacity as its Attorney in Fact obligates his said company, as surety for the said Contractor, unto the said University, up to the sum of _____. The condition of this Performance and Payment Bond shall be that should the Contractor herein not perform the contract in accordance with the terms and conditions hereof, or should said Contractor not fully indemnify and save harmless the University, from all cost and damages which he may suffer by said Contractor's nonperformance or should said Contractor not pay all persons who have and fulfill obligations to perform labor and/or furnish materials in the prosecution of the work provided for herein, including by way of example workmen, laborers, mechanics, and furnishers of materials, machinery, equipment and fixtures, then said Surety agrees and is bound to so perform the Contract upon demand by the University and make said payments in accordance with law.

Provided, that any alterations which may be made in the terms, of the Contract or in the work to be done under it, or the giving by the University of any extensions of time for the performance of the Contract, or any other forbearance on the part of either the University or the Contractor to the other shall not in any way release the Contractor or the Surety from their liability hereunder, notice to the Surety of any such alterations, extensions or other forbearance being hereby waived.

In Witness whereof, the parties hereto on the day and year first above written have executed this agreement in _____ counterparts, each of which shall, without proof or accountancy for the other counterparts, be deemed an original thereof.

This Performance and Payment Bond is accompanied by appropriate Power of Attorney.

WITNESSES:

(CONTRACTOR)

BY: _____
(TITLE)

THE UNIVERSITY OF NEW ORLEANS

BY: _____

(TITLE)

(SURETY)

(ATTORNEY-IN-FACT)

STATE OF LOUISIANA
PARISH OF _____

AFFIDAVIT ATTESTING THAT PUBLIC CONTRACT
WAS NOT, NOR WILL NOT BE SECURED
THROUGH EMPLOYMENT OR PAYMENT OF SOLICITOR

KNOW ALL MEN BY THESE PRESENT, that a public contract is
contemplated between the UNIVERSITY OF NEW ORLEANS and:

(contractor)

represented by _____,
(title)

who attests that he is empowered and authorized to execute said
documents.

FURTHER, _____, who being duly sworn, does depose and attest that:

(1) Affiant employed no person, corporation, firm, association, or other organization, either directly or indirectly, to secure the public contract under which he received payment, other than persons regularly employed by the affiant whose services in connection with the construction of the public building or project or in securing the public contract were in the regular course of their duties for affiant; and

(2) No part of the contract price received by affiant was paid or will be paid to any person, corporation, firm, association, or other organization for soliciting the contract, other than the payment of their normal compensation to persons regularly employed by the affiant whose services in connection with the construction of the public building or project were in the regular course of their duties for affiant.

WITNESSES:

BEFORE ME, the undersigned authority, personally appeared, who being duly sworn, deposes the states that the above is true and correct in all respects recited.

SWORN TO AND SUBSCRIBED before me this __ day of __, 20__

NOTARY PUBLIC

Name of Project

Project No.

STATE OF _____

PARISH OF _____

ATTESTATIONS AFFIDAVIT

Before me, the undersigned notary public, duly commissioned and qualified in and for the parish and state aforesaid, personally came and appeared Affiant, who after being duly sworn, attested as follows:

LA. R.S. 38:2227 PAST CRIMINAL CONVICTIONS OF BIDDERS

A. No sole proprietor or individual partner, incorporator, director, manager, officer, organizer, or member who has a minimum of a ten percent (10%) ownership in the bidding entity named below has been convicted of, or has entered a plea of guilty or nolo contendere to any of the following state crimes or equivalent federal crimes:

(a) Public bribery (R.S. 14:118)

(c) Extortion (R.S. 14:66)

(b) Corrupt influencing (R.S. 14:120)

(d) Money laundering (R.S. 14:230)

B. Within the past five years from the project bid date, no sole proprietor or individual partner, incorporator, director, manager, officer, organizer, or member who has a minimum of a ten percent (10%) ownership in the bidding entity named below has been convicted of, or has entered a plea of guilty or nolo contendere to any of the following state crimes or equivalent federal crimes, during the solicitation or execution of a contract or bid awarded pursuant to the provisions of Chapter 10 of Title 38 of the Louisiana Revised Statutes:

(a) Theft (R.S. 14:67)

(f) Bank fraud (R.S. 14:71.1)

(b) Identity Theft (R.S. 14:67.16)

(g) Forgery (R.S. 14:72)

(c) Theft of a business record
(R.S.14:67.20)

(h) Contractors; misapplication of
payments (R.S. 14:202)

(d) False accounting (R.S. 14:70)

(i) Malfeasance in office (R.S. 14:134)

(e) Issuing worthless checks
(R.S. 14:71)

LA. R.S. 38:2212.10 Verification of Employees

- A. At the time of bidding, Appearer is registered and participates in a status verification system to verify that all new hires in the state of Louisiana are legal citizens of the United States or are legal aliens.
- B. If awarded the contract, Appearer shall continue, during the term of the contract, to utilize a status verification system to verify the legal status of all new employees in the state of Louisiana.
- C. If awarded the contract, Appearer shall require all subcontractors to submit to it a sworn affidavit verifying compliance with Paragraphs (A) and (B) of this Subsection.

Name of Project

Project No.

LA. R.S. 23:1726(B) Certification Regarding Unpaid Workers Compensation Insurance

- A. R.S. 23:1726 prohibits any entity against whom an assessment under Part X of Chapter 11 of Title 23 of the Louisiana Revised Statutes of 1950 (Alternative Collection Procedures & Assessments) is in effect, and whose right to appeal that assessment is exhausted, from submitting a bid or proposal for or obtaining any contract pursuant to Chapter 10 of Title 38 of the Louisiana Revised Statutes of 1950 and Chapters 16 and 17 of Title 39 of the Louisiana Revised Statutes of 1950.
- B. By signing this bid /proposal, Affiant certifies that no such assessment is in effect against the bidding / proposing entity.

NAME OF BIDDER

NAME OF AUTHORIZED SIGNATORY OF BIDDER

DATE

TITLE OF AUTHORIZED SIGNATORY OF BIDDER

**SIGNATURE OF AUTHORIZED
SIGNATORY OF BIDDER/AFFIANT**

Sworn to and subscribed before me by Affiant on the _____ day of _____, 20____.

Notary Public

LOUISIANA UNIFORM PUBLIC WORK BID FORM

TO: University of New Orleans – Main Campus
Purchasing Office
Administration Annex, Room 1004G
New Orleans, Louisiana 70148
(Owner to provide name and address of owner)

BID FOR: BTB #2664 - Chemical Science Annex
Outside Air Unit Replacement
Main Campus – University of New Orleans
New Orleans, LA 70148
(Owner to provide name of project and other identifying information)

The undersigned bidder hereby declares and represents that she/he: a) has carefully examined and understands the Bidding Documents, b) has not received, relied on, or based his bid on any verbal instructions contrary to the Bidding Documents or any addenda, c) has personally inspected and is familiar with the project site, and hereby proposes to provide all labor, materials, tools, appliances and facilities as required to perform, in a workmanlike manner, all work and services for the construction and completion of the referenced project, all in strict accordance with the Bidding Documents prepared by: Crumb Engineering, LLC 4609 Fairfield Street Metairie, LA 70006 and dated: July 16, 2021
(Owner to provide name of entity preparing bidding documents.)

Bidders must acknowledge all addenda. The Bidder acknowledges receipt of the following **ADDENDA:** (Enter the number the Designer has assigned to each of the addenda that the Bidder is acknowledging) _____ .

TOTAL BASE BID: For all work required by the Bidding Documents (including any and all unit prices designated “Base Bid” * but not alternates) the sum of:

_____ Dollars (\$ _____)

ALTERNATES: For any and all work required by the Bidding Documents for Alternates including any and all unit prices designated as alternates in the unit price description.

Alternate No. 1 *(Owner to provide description of alternate and state whether add or deduct)* for the lump sum of:

_____ Dollars (\$ _____)

Alternate No. 2 *(Owner to provide description of alternate and state whether add or deduct)* for the lump sum of:

_____ Dollars (\$ _____)

Alternate No. 3 *(Owner to provide description of alternate and state whether add or deduct)* for the lump sum of:

_____ Dollars (\$ _____)

NAME OF BIDDER: _____

ADDRESS OF BIDDER: _____

LOUISIANA CONTRACTOR’S LICENSE NUMBER: _____

NAME OF AUTHORIZED SIGNATORY OF BIDDER: _____

TITLE OF AUTHORIZED SIGNATORY OF BIDDER: _____

SIGNATURE OF AUTHORIZED SIGNATORY OF BIDDER **: _____

DATE: _____

THE FOLLOWING ITEMS ARE TO BE INCLUDED WITH THE SUBMISSION OF THIS LOUISIANA UNIFORM PUBLIC WORK BID FORM:

* The Unit Price Form shall be used if the contract includes unit prices. Otherwise it is not required and need not be included with the form. The number of unit prices that may be included is not limited and additional sheets may be included if needed.

** **A CORPORATE RESOLUTION OR WRITTEN EVIDENCE** of the authority of the person signing the bid for the public work as prescribed by LA R.S. 38:2212(B)(5).

BID SECURITY in the form of a bid bond, certified check or cashier’s check as prescribed by LA R.S. 38:2218(A) attached to and made a part of this bid.

LOUISIANA UNIFORM PUBLIC WORK BID FORM

UNIT PRICE FORM

TO: _____

(Owner to provide name and address of owner)

BID FOR: _____

(Owner to provide name of project and other identifying information)

UNIT PRICES: This form shall be used for any and all work required by the Bidding Documents and described as unit prices. Amounts shall be stated in figures and only in figures.

DESCRIPTION:	<input type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# ____			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION (<i>Quantity times Unit Price</i>)

DESCRIPTION:	<input type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# ____			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION (<i>Quantity times Unit Price</i>)

DESCRIPTION:	<input type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# ____			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION (<i>Quantity times Unit Price</i>)

DESCRIPTION:	<input type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# ____			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION (<i>Quantity times Unit Price</i>)

DESCRIPTION:	<input type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# ____			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION (<i>Quantity times Unit Price</i>)

DESCRIPTION:	<input type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# ____			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION (<i>Quantity times Unit Price</i>)

DESCRIPTION:	<input type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# ____			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION (<i>Quantity times Unit Price</i>)

DESCRIPTION:	<input type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# ____			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION (<i>Quantity times Unit Price</i>)

Wording for “DESCRIPTION” is to be provided by the Owner.

All quantities are estimated. The contractor will be paid based upon actual quantities as verified by the Owner.

UNIVERSITY OF NEW ORLEANS				PAYMENT REQUEST #		Page ____ of ____	
Project:				Contractor: Mailing Address:			
SP#		SB#					
CHANGE ORDER SUMMARY							
Change Order History		ADDITIONS		DEDUCTIONS			
Number	Date						
TOTALS							
Net Change by Change Orders							
UNIVERSITY OF NEW ORLEANS	FS	I CERTIFY THAT THE GOODS OR SERVICES REFERENCED ON THIS INVOICE HAVE BEEN RENDERED AND PAYMENT OF THESE CHARGES IS ACCEPTABLE AS INDICATED BELOW.					
	DATE RECEIVED: _____ DEPARTMENT CHAIRMAN/ AUTHORIZED REPRESENTATIVE: _____ _____ APPROVED WITHOUT EXCEPTION _____ APPROVED WITH EXCEPTION(S) AS NOTED						
PURCHASING ONLY	P	P.O. NO. _____ DATE _____ V# _____ ACCOUNT NO. _____ OBJECT _____ BPO _____ E.O. NO. _____ COMPLETE () PARTIAL () APPROVED _____ DATE _____					
		APPROVALS		ORIGINAL CONTRACT SUM.....		\$ _____	
				Net change by Change Orders.....		\$ _____	
				CONTRACT SUM TO DATE.....		\$ _____	
				TOTAL COMPLETED & STORED TO DATE..... (See Schedule of Values)		\$ _____	
				RETAINAGE _____ %.....		\$ _____	
				TOTAL EARNED LESS RETAINAGE.....		\$ _____	
				LESS PREVIOUS PAYMENTS/APPLICATIONS.		\$ _____	
				PAYMENT DUE THIS REQUEST.....		\$ _____	
				CONTRACTOR:		DATE:	
				ARCHITECT:		DATE:	
				FS:		DATE:	

TECHNICAL SPECIFICATIONS

UNIVERSITY of NEW ORLEANS

SECTION 01000

GENERAL CONDITIONS

The general conditions of these Technical Specifications, including amendments and additions thereto, apply to each and every heading included in these Technical Specifications with the same force as though repeated in full under each heading respectively.

1.01 SCOPE

BASE BID:

Provide the materials, labor, equipment and supervision necessary to the completion of all work in accordance with Drawings dated 7/16/2021 and these Technical Specifications for the renovation of Chemical Science Annex Outside Air Unit Replacement as prepared by Crumb Engineering, LLC.

Opportunity for the site visit and inspection is provided under Article 8 of the "INSTRUCTIONS."

1.03 REVIEW OF QUOTING DOCUMENTS

The Contractor shall carefully study and compare the field conditions, Drawings and Technical Specifications and shall at once report to the University Representative errors, inconsistencies or omissions discovered.

Maintain one (1) complete set of Quoting Documents and Change Orders at the site during the work.

1.04 PROJECT MEETINGS

If called by the University Representative, a Pre-Construction Conference between the Contractor, his on-site representative and the University Representative will be held in order to clarify and direct University policy and specific items of concern as pertain to the Contract. Present copies of the project Schedule of Values, List of Subcontractors and Construction Schedule to the University Representative. University standard forms for this information are available through the University Representative.

Progress meetings will be scheduled at the discretion of the University Representative depending on the progress of the work.

1.05 COORDINATION

Coordinate installation schedule with the University Representative so as not to interfere with the ongoing operation of the University. If for any reason, shut down of utilities is required on this project, it is imperative that the University Representative be consulted.

1.06 SUPERVISION

The Contractor shall provide consistent, capable supervision at all times during the work.

Provide telephone service at the Project site. Service may be cellular or hard-wired, at the Contractor's option. Telephone service shall not be discontinued until after final acceptance of the project.

1.07 SUBSTITUTIONS

Substitutions to specified materials require approval of the University Representative prior to the opening of quotes (Article 3.3 of the "INSTRUCTIONS"). Substitutions not approved prior to opening of quotes are subject to rejection and replacement with the specified materials.

1.08 SUBMITTALS

Submit all required shop drawings, brochures and samples for review by the University Representative prior to ordering and/or installing materials. Equipment or material ordered and/or installed without review by the University Representative is subject to rejection. Reproduction and edit of the Quoting Documents for use as shop drawings is not permitted.

Shop Drawings: Submit one electronic copy and three (3) blue line prints. An electronic copy will be returned.

Brochures, Cut Sheets, and Technical Data: Submit one electronic copy and two (2) copies. An electronic copy will be returned.

Samples: Submit one (1) each to be retained by the University.

1.09 QUALITY ASSURANCE

Use new materials of quality acceptable to the University Representative and meeting all applicable regulations as pertain to this project. Remove and replace all material delivered to site which, in the opinion of the Representative, does not meet specifications and quality.

The University expects quality workmanship and only those who are qualified to perform the tasks in their respective trades are acceptable. The term qualified above is understood to mean "Journeymen" skilled in their respective trades. Correct, at no expense to the University, any work performed which, in the opinion of the University Representative, is found unacceptable or not according to code.

Where equipment is furnished as part of the bid, the successful bidder must be equipped to provide prompt factory authorized and qualified local service. The qualified service provider must have been in business locally for a minimum of three (3) years and must have an office within fifty (50) miles of New Orleans, LA. Service manuals for all furnished equipment must be supplied as part of the project. These manuals must include blueprints and schematics of the equipment supplied. The job will not be considered complete until the required manuals and schematics have been supplied to the University.

The use and/or inclusion of any hazardous materials, including, but not limited to, asbestos, PCB, or any other hazardous substance which is forbidden by state or federal regulations, laws, or codes is expressly forbidden. If these materials are found to be present as part of the material or equipment supplied, or if existing hazardous materials were disturbed as part of the work done, all remedial actions, fines, and expenditures will be borne by the Contractor.

1.10 TRAFFIC CONTROL

Coordinate the schedule of delivery vehicles which will interfere with normal campus traffic. When deliveries are made from the street curb, provide sufficient properly attired and equipped flagmen to safely control and maintain the flow of traffic.

It is the policy of the University of New Orleans to provide full access to all disabled individuals in

all areas possible. Because of this commitment, contractors, vendors or servicing agencies are cautioned to ensure that their staff is made aware of this commitment. When parking on the campus of this University, it shall be the responsibility of the contractor, vendor or servicing agency to ensure that no sidewalks or access ways are blocked at any time. If temporary blocking is required, the Contractor, shall assume the responsibility for the safe transit of all disabled persons.

Park only in authorized areas; comply with all traffic and parking regulations of the University. The University will furnish the Contractor, at no charge, permits for all vehicles which will be parked in the designated parking areas.

1.11 PROJECT CONDITIONS

- A. Conduct building demolition so University's operations will not be disrupted.
 - 1. Provide not less than 48 hours' notice to the University Representative of activities that will affect University's operations.
 - 2. Maintain access to existing exits and other adjacent occupied or used facilities.
 - a. Do not close exits or other occupied or used facilities without written permission from authorities having jurisdiction.
- B. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the University Representative. Hazardous materials will be removed by University under a separate contract.
- C. Storage or sale of removed items or materials on-site is not permitted.

1.12 PROTECTION

Protect adjacent buildings and building elements from damage during the work. Protect the site, including trees, shrubs, vegetation and lawn areas; where damage does occur, restore to original condition replacing damaged vegetation and lawn with equal size and species.

Store construction materials with care; distribute the weight to not endanger the building structure.

Contractor shall verify the exact locations of underground utilities. Damage to existing utilities shall be immediately repaired by the Contractor at his own expense to restore the interrupted service. Work at night and/or on weekends if deemed necessary by the University Representative. Restoration may involve repair and/or replacement of damaged section with new, without credit for condition or useable life of the damaged utility.

1.13 ROUGH-IN INSPECTION

At the completion of the rough-in work, before any closing of wall, ceiling, or floor; schedule a rough-in inspection for the

University Representative's approval. Give the University Representative a 48-hour notice.

1.14 CLEANUP

Daily, as it accumulates, remove from the work site, all rubbish, debris and unsalvageable material resulting from the work. Do not permit trash to accumulate. Do not use individual building dumpsters for trash disposal.

1.15 SAFETY

Provide sufficient continuous barricades to identify the work site and restrict entry. Where necessary, equip barricades with warning lights for night use.

Provide measures necessary to ensure and maintain security at the work site; protect from theft, vandalism, personal injury, and property damage. Erect and maintain temporary enclosures and barriers to prevent unauthorized access to the site.

Provide fire protection equipment during the construction period, including not less than two (2) ten (10) pound capacity multi-purpose A-B-C dry chemical extinguishers (10A:40BC).

If indicated on the Drawings, provide a temporary fence to isolate the construction site and restrict unauthorized entry. Use chain link fence material, 6'-0" minimum height, on steel or wood posts spaced a 6'-0" maximum and embedded 2'-6" minimum below existing grade; include personnel and/or equipment access gates. Coordinate fence installation with underground utilities - see 1.11; before installation, confirm fence location and layout with the University Representative.

1.16 WARRANTY

Warranty all workmanship and material for a period of one year from date of acceptance. During this period, the University will notify the Contractor of any discrepancy for prompt correction at no expense to the University.

At the discretion and initiation of the University Representative, a one-year warranty review meeting with the Contractor will be held to review warranty items which remain incomplete.

Provide all equipment, material, labor, and extended labor warranties in an electronic copy labeled per specification section. List manufacturer, model #, subcontractor and/or vendor associated with each piece of equipment and material.

1.17 CHANGES TO THE WORK

When required, changes to the work will be documented and the contract price adjusted by written change order issued by the University to the Contractor. Time extensions will be handled by change order.

Itemize material and labor costs. Include quantities and unit costs. Submit a separate breakdown for each Subcontractor. Document all cost.

Compute overhead and profit as follows:

1. When all of the work is General Contractor work: 15% of the cost the work.
2. When the work is all Subcontract work: 15% of the cost of the work for Subcontractor's overhead and profit plus 10% of the cost of the work for General Contractor's overhead and profit.
3. When the work is a combination of General Contractor work and Subcontract work: 15% of the cost of the subcontract work for Subcontractor's overhead and profit plus 10% of the

cost of the Subcontractor's work for General Contractor's overhead and profit plus 15% of the cost of general contract work for General Contractor's overhead and profit.

Cost of the work: all costs necessarily incurred in performance of the work and paid by the contractor.

This includes:

1. Wages paid.
2. Cost of all materials and supplies.
3. Rental of necessary machinery and equipment.
4. Applicable taxes, insurance, fringe benefits, unemployment compensation, social security, old age and bond premiums.
5. Any other documented costs.

1.18 ACCEPTANCE

When, in the mutual opinions of the Contractor and the University Representative, the work is judged substantially complete, a meeting at the site will be held to inspect the work and to identify and list those items which are incomplete and/or not in compliance with the Quoting Documents, Contract and all Change Orders. Consultants to the University may be in attendance at the meeting as well the subcontractors invited by the Contractor. The list developed forms the "Punch List" for the project.

A value equal to the material, labor, equipment and supervision cost incidental to the completion and/or correction of each item on the Punch List will be assessed by the University Representative and Consultants. The total value of all items on the Punch List is designated "Special Retainage" and will be withheld from the Contractor's final payment until all items on the Punch List have been completed and/or corrected.

The project will be accepted at the discretion of the University Representative based on the extent of the Punch List. The Acceptance Certificate will be subsequently issued to the Contractor by the University.

Unless otherwise required by the University Representative and agreed to by the Contractor, all punch list items will be corrected and/or completed within thirty (30) calendar days of the acceptance date.

1.19 TEMPORARY UTILITIES

The Contractor may use reasonable amounts of the utility services available to the site at no charge from the University. The University will not provide utility service beyond that existing. Coordinate tie-in and disconnect to the existing utilities with the University Representative.

Locate temporary facilities so as not to interfere with the University's use of the Project site and/or surrounding areas. Relocate non-complying facilities at no expense to the University.

1.20 AS-BUILT DOCUMENTS

Maintain one set of Quoting Documents and Change Orders on the job site for recording changes to the work and as-built conditions as they occur. Upon completion of the work (at the acceptance inspection) present the record set to the University Representative for posting along with an electronic set of the as-built set.

1.21 TEMPORARY SANITARY FACILITIES

Existing facilities in the building may be used by construction personnel during work on this project.

1.22 MISCELLANEOUS

Only the General Contractor may erect a job sign: 24" by 36" maximum at a location approved by the University Representative before installation.

END

SECTION 01040 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

The General Provisions of the Contract, including General and Supplementary Conditions, and General Requirements apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

- A. Furnish all labor, materials, tools, and equipment, and perform all operations necessary for cutting and patching work indicated or specified.
- B. Definition: "Cutting-and-Patching" is hereby defined to include but is not necessarily limited to the cutting and patching of nominally completed and previously existing work, in order to accommodate the coordination of the work, or to uncover other work for access or inspection, or to obtain samples for testing, or for similar purposes; and is defined to exclude integral cutting-and-patching during the manufacturing, fabricating, erecting and installing process for individual units of work. Drilling the work to install fasteners and similar operations are excluded from the definition of cutting-and-patching.

1.3 QUALITY ASSURANCE

A. Requirements for Structural Work

General: Do not cut-and-patch work in a manner resulting in a reduction of load-carrying capacity or load/deflection ratio. Do not cut or core existing concrete joists or beams.

B. Visual Requirements

General: Do not cut-and-patch work which is exposed on the exterior or exposed in occupied spaces of the building, in a manner resulting in a reduction of visual qualities or resulting in substantial evidence of the cut-and-patch work, both as judged solely by the University Representative. Remove and replace work judged by the University Representative to be cut-and-patched in a visually unsatisfactory manner. All concrete shall be saw cut and removed back to nearest expansion joint.

PART 2 - PRODUCTS

2.1 MATERIALS

General: Except as otherwise indicated or approved by the University Representative, provide materials for cutting-and-patching which will result in equal-or-better work than the work being cut-and-patched, in terms of performance characteristics and including visual effect where applicable. Comply with the original materials where feasible and where recognized that satisfactory results can be produced thereby. Provide matching ceiling tile where existing tile is damaged.

PART 3 - EXECUTION

CUTTING AND PATCHING

July 16, 2021

01040 - 1

3.1 PREPARATION

- A. Temporary Support: Provide adequate temporary support for work to be cut, to prevent failure. Do not endanger other work.
- B. Protection: Provide adequate protection of other work during cutting-and-patching, to prevent damage; and provide protection of the work from adverse weather exposure.

3.2 CUTTING AND PATCHING

- A. Employ skilled tradesmen to perform cutting and patching. Except as otherwise indicated or approved by the University Representative, proceed with cutting-and-patching at the earliest feasible time, in each instance, and perform the work promptly.
- B. Cut work by methods least likely to damage work to be retained and work adjoining.
- C. Patch with seams that are durable and as invisible as possible. Comply with specified tolerances for the work.
- D. Restore exposed finishes of patched areas; and, where necessary extend finish restoration onto retained work adjoining, in a manner which will eliminate evidence of patching.
- E. Where patch occurs in a smooth painted surface, extend final paint coat over the entire unbroken surface containing the patch, after patched area has received prime and base coats.

END OF SECTION - 01040

SECTION 02221

BUILDING DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes demolition and removal of the following:
 - 1. Selective Demolition: To allow for installation of new work as indicated on drawings.

1.02 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of any material away from University Property unless indicated to be re-installed, removed and salvaged or recycled. Items to be reinstalled shall be properly stored.

1.03 SUBMITTALS

- A. Schedule of Building Demolition Activities: Indicate detailed sequence of demolition and removal work.
- B. Predemolition Photographs: Show existing conditions of adjoining construction that might be misconstrued as damage caused by building demolition operations. Submit before Work begins.

1.04 PROJECT CONDITIONS

- A. Conduct building demolition so the University's operations will not be disrupted.
 - 1. Provide not less than 72 hours' notice to the University Representative of activities that will affect the University's operations.
 - 2. Maintain access to existing exits and other adjacent occupied or used facilities.
 - a. Do not close exits or other occupied or used facilities without written permission from authorities having jurisdiction.
- B. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the University Representative. Hazardous materials will be removed by the University under a separate contract.
- C. Storage or sale of removed items or materials on-site is not permitted.

1.05 COORDINATION

- A. Arrange demolition schedule so as not to interfere with University's on-site operations.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of building demolition required.
- B. If required, request and review Project Record Documents of existing construction provided by the University. The University does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Inventory and record the condition of items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to the University Representative.

3.02 PREPARATION

- A. Removed and Salvaged Items: Comply with the following:
 - 1. University Representative shall indicate items to be salvaged.
 - 2. Clean salvaged items of dirt and demolition debris.
 - 3. Store items in secure area until delivery to University.
 - 4. Provide construction filters for HVAC during entire project. Change all AHU filters at the completion of the project.

3.03 REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by building demolition operations.
- B. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
- C. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

END OF SECTION 02221

SECTION 15050 – GENERAL MECHANICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

- A. The work to be done under this heading includes the furnishing of labor, materials, equipment, and service necessary for and reasonably incidental to the proper completion of all mechanical work as shown on the drawings and herein specified.
- B. Visit and examine the job site, and with all authorities concerned in order to become familiar with all existing conditions pertinent to the work to be performed thereon. No additional compensation will be allowed for failure to be so informed. Pay all costs and fees for utility connections.
- C. Materials and equipment shall be new, except where otherwise indicated, of the best quality, with same brand of manufacturer for all similar material.
- D. All work shall be performed in a neat and workmanlike manner, and in accordance with all codes, standards, and requirements of the industry.
- E. In general, provide the installation of piping, fittings, equipment, etc.
- F. Regardless of titles and subdivisions herein employed, consider these specifications as one complete document with General Section applying to all other sections. All bidders are cautioned to read entire specifications and to thoroughly familiarize themselves with all requirements thereof.
- G. Check all specifications and all drawings and bring to attention any conflicts or variations as shown as noted.
- H. Specifications and accompanying drawings apply to all contracts or sub-contracts entered into for supplying material or labor for construction of work specified herein and shown on drawings.
- I. Protect University and University Representatives from any and all damages and expense arising from fulfillment of contract and at completion of work repair all damages done.
- J. For any points which are not clear, or for items and/or details which the Contractor feels are in need of clarification, consult the University Representative before submission of a proposal.
- K. The drawings and the specifications are complementary and what is shown and/or called for on one shall be furnished and installed the same as if shown and/or called for in the other.

- L. In case of discrepancies and/or ambiguities in the drawings and/or in the specifications, the University Representative shall be consulted prior to submission of a proposal. Failure to do so on the part of the successful bidder shall be construed as explicit agreement on his part to abide by the University Representative's decision in such matters.
- M. The word "provide" as used in these Specifications and on the Drawings shall be termed to mean "furnish and install".
- N. If the Contractor notices during the bidding any items of the contract documents which will violate any applicable code, these items shall be brought to the attention of the University Representative before the bid date. Failure to bring these items to the attention of the University Representative shall be construed as explicit agreement that the Contractor has included in his bid price any and all modifications necessary to complete the project in accordance with all applicable codes.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Power wiring for all equipment shall be done under ELECTRICAL SECTION 16010.
- C. Piping penetrations through fire rated partitions/floors shall be fire sealed in accordance with the UL fire resistance directory. The integrity of the fire rating, as indicated on the architectural drawings, shall be maintained.

1.4 QUALITY ASSURANCE

- A. The Contractor bidding on this portion of the work must be fully experienced in installations of equal size, complexity, and quality, and must be licensed as a mechanical contractor to perform such work as required by the Louisiana State Legislature, R.S.37:2152-2163.
- B. In bidding he acknowledges that he fully understands the scope of work and design, and has the ability for the contract price to assemble and install the equipment, piping and ductwork shown or specified, so as to mold same into a satisfactory workable system and arrangement.
- C. Contractor shall recognize that a fault or error in his work remains his responsibility regardless of whether such difficulty was discovered after the work had progressed, and shall make corrections at no cost to the Owner.
- D. Adequate and competent constant supervision shall be provided by Contractor to assure that work is done in accordance with good standard practice and workmanship and with intent of drawings and specifications. Contractor shall recognize that amount of information and detail could be provided to contract documents is limitless and could extend into every minute detail and sequence of operations, to a point where only workmen would be required, without drawing on ability, experience and ingenuity of the Contractor.
- E. All work shall be installed in strict accordance, with all existing local and state codes and ordinances, with National Board of Fire Underwriters
- F. This Contractor shall secure all permits and inspections and shall pay all fees and taxes and shall provide University with certificates of approval from agencies having jurisdiction over various phases of work.

- G. Contractor shall maintain and service all equipment until time of acceptance by University. Contractor shall include all required service access in the installation as required by the manufacturer and governing codes.
- H. Prior to starting any work, the Contractor shall submit a quality assurance plan for approval by the University Representative. In the quality assurance plan, the Contractor shall provide the following information:
 - 1. List of all sub-contractors and equipment suppliers.
 - 2. List of all foreman and job superintendents including job experience for all trades.
 - 3. Construction time schedule demonstrating coordination with other trades and showing detailed time lines for test and balance and commissioning being completed prior to final punch list inspection.

1.5 SUBMITTALS

A. Shop Drawings and Submittal Data required:

- 1. Submit to the University Representative for review, complete descriptive information and dimensional data on all items of equipment, materials and accessories, including duct, equipment and sprinkler layouts. Piecemeal submissions shall not be approved. Written approval thereof must be obtained before ordering or installation. The following shall be submitted:

Variable Frequency Drives
Valves and Fittings
Insulation
Equipment Layout Drawings
Ductwork Shop Drawings
UV Lights

Air Handling Units
Control System Reports
Temperature Controls

- 2. Shop drawings and submittal data shall be considered to be instruments of service only and submitted for the sole purpose of convenience to the Contractor to assist him in the performance of the contract. The University Representative's review of the shop drawings and submittal data shall not supersede these specifications, the accompanying drawings, or the contract terms, unless specifically covered by a properly executed change order, and then only to the extent specifically and explicitly stipulated therein.
- 2. Submit in accordance with requirements of Section 01000.
- 3. Ductwork shop drawings shall be at a minimum 1/4" scale. Duct shop drawings shall show the following:
 - a. All structural members larger than 4".
 - b. All hydronic piping 2" or larger.
 - c. All conduit 2" or larger.
 - d. All duct fittings, take-offs, volume dampers, control devices and fire dampers.
 - e. All grilles, louvers, registers and diffusers.
 - f. Duct dimensions and insulation methods.
 - g. Duct dimensioned from structural beams and columns.
 - h. Architectural ceiling heights, furrings, chases, etc.
 - i. Cross-sections in areas of congestion or conflict.
 - j. Installation details for all duct and related equipment.

- k. Lights, speakers, smoke detectors and other ceiling mounted devices.
- B. After completion of project Contractor shall turn over to the University Representative complete operating and maintenance instructions including listing of supply and repair items and locations of places to purchase same.
- C. Substitutions:
 - 1. All material, equipment, methods, and accessories entering into the work under this section of contract are subject to approval or disapproval of the University. Approval of any manufacturer, material, or product shall not constitute a waiver of University's right to demand full compliance with contract requirements, including shape, size, quality and performance.
 - 2. Equality of materials is that established by opinion of University. Decision of University is final.
 - 3. Whenever a material or article of equipment is specified by use of a proprietary name, or by naming the manufacturer or vendor, any material or article which will perform adequately the duties imposed by the design will be considered for substitution, providing it is of equal substance, and function, meets specifications, and is aesthetically acceptable to the University. Refer to Division 1 Sections for approval procedures.
 - 4. Literature, technical data, etc., includes complete data and samples if necessary, with submissions for substitutions. Burden of proof that material offered for substitution is equal, or superior, in construction and efficiency to that named, rests on Contractor, and unless proof is satisfactory to University Representative, substitution will not be approved.
- D. See Specifications for "As-Built" requirements.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

Take necessary precautions to protect all material, equipment, apparatus and work from damage. Failure to do so to the satisfaction of the University Representative will be sufficient cause for the rejection of the material, equipment or work in question. Contractor is responsible for the safety and good condition of the materials installed until final acceptance by the University.

1.7 JOB CONDITIONS

- A. Accompanying drawings, including plans, details, diagrams, notes, etc., are shown to limit and explain structural conditions, construction requirements, sizes, capacities and method of installation and erection. Structural and other conditions may require certain modifications and adjustments from conditions shown. Such deviations are permissible; however, specific sizes capacities and requirements affecting the satisfactory performance and operation of the installation shall remain unchanged. Make allowance for normal job conditions and interferences.
- B. Whenever it becomes necessary to shift ducts or pipes or to change shape of ducts, such changes shall be referred to University Representative for approval.

- C. Ask for details whenever uncertain about method of installation. Lack of details not requested shall not excuse improper installation and correction shall be responsibility of Contractor.
- D. Schedule and perform all mechanical work to avoid delays to the Contractor and other trades.
- E. In addition to the basic work covered under this contract, the Contractor shall plan and schedule the work to permit continuous operation of essential services of existing facilities. Planning shall also include scheduling necessary interruptions of service on water lines, drain lines, etc., to existing building at times when such interruptions will cause minimum interference with existing routine and services. All such interruptions shall be made only after consultation with the University. This is extremely important since included in the work is a relocation and rerouting of and connecting to existing facilities, piping, etc. No additional compensation will be allowed for failure to be so informed.
- F. It is essential that all adjacent areas of the school be kept in operation at all times, except when specific permission is given to contrary. Before any lines or equipment are shut down for disconnecting, tie-ins, or rearranging of services, make arrangements with Architect to do this work at night, or Sunday, or at special time of day or year with length of shutdown agreed upon before work is begun. Contractor to bear any overtime or work costs in the connection.
- G. All piping, cleanouts and covers, and other mechanical items in way of construction or remodeling, shall be rerouted, relocated or otherwise adjusted to work out with such construction or changes shown or specified in any or all of various sections of specifications. Unknown piping that is encountered will be referred immediately to University Representative for method of disposition before continuation of work.

1.8 GUARANTEE AND SERVICE

- A. Guarantee all equipment, materials, and workmanship for a period of one (1) year following date of acceptance.
- B. During the period of guarantee any defects in equipment, materials, or workmanship shall be promptly corrected without cost to the University.
- C. Guarantee includes equipment capacity and performance ratings specified without excessive noise levels. Any deficiencies in equipment capacity specified shall be promptly corrected.
- D. Guarantee does not include maintenance items.

PART 2 - PRODUCTS

2.1 TOOLS AND SCAFFOLDING

Furnish all tools, equipment, scaffolding and other facilities required to properly and expeditiously perform the work.

2.2 SIPHON PREVENTORS

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Furnish and install on all equipment and fixtures requiring same, backflow preventors or vacuum breakers of a type approved by the Louisiana Health and Human Resources. Water connections to fixtures and equipment shall be made in such a way as to prevent back siphonage when the water supply is out or the pressure drops. Provide reduced pressure type back flow preventors where indicated on drawings or required by Code. They shall be Watts series 900 or Febco Series 825, size as indicated on drawings.

2.3 SLEEVES AND THIMBLES

- A. Pipe sleeves - wrought iron or cast iron of sufficient size for piping and installation to be installed in floors, walls below grade, and grade beams where piping passes through.
- B. Thimbles above grade - heavy galvanized steel of proper size to allow freedom of piping and insulation, set in floor or roof slab as work progresses, also to be installed in wall and partitions where piping passes through.
- C. Thimbles below grade - same as pipe sleeves above.
- D. Sleeves through floors extend 1/4" above finished floor. Caulk around and seal all piping in chases and piping passing through floor slab.
- E. Provide sleeve seals and shields for all pipe penetrations of ground floor slab.
- F. Provide fire-stopping in all pipe penetrations of rated floors and walls.

2.4 BUCKS, GROUNDS AND CHASES

- A. Be responsible for proper location and sizes or for any errors or omission in placing same.
- B. Failure to inform the General Contractor promptly of such requirements shall not relieve the Mechanical installer of the responsibility for providing a complete mechanical system.

2.5 HANGERS

- A. Horizontal piping above grade without hubs shall be rigidly supported. Distance between pipe supports:
 - 1. 1/2" pipe 6'-0" maximum
 - 2. 3/4" pipe 7'-0" maximum
 - 3. 1" pipe 8'-0" maximum
 - 4. 1 1/4" pipe 9'-0" maximum
 - 5. 1 1/2" pipe and over 10'-0" maximum
- B. Hangers shall be similar to "Split Ring" type.
- C. Metal strap or wire will not be acceptable.
- D. For two or more systems of piping run parallel and with same grade trapeze hangers may be used.

- E. Use #22 gauge galvanized sheet steel saddles between the pipe covering and each pipe hanger on all insulated lines. Saddles shall extend along pipe runs and at least half way up piping on each side.

- F. Rods supporting pipe hangers shall have the following dimensions:

½" to 2" pipe	3/8" rod
2-1/2" to 3" pipe	½" rod
4" to 5" pipe	5/8" rod
6" pipe	¾" rod
8" through 12"	7/8" rod

Rods for trapeze hangers shall be a minimum of 3/8" and shall have the equivalent cross section, listed above, per pipe supported.

2.6 PAINTING AND IDENTIFICATION

- A. Equipment, including pumps, motors, and similar factory fabricated and assembled units shall be furnished with factory applied protective prime coat paint of finished baked enamel. Equipment surfaces damaged during course of construction or shipment shall be refinished by the Contractor.
- B. Uncoated black ferrous piping and fittings shall be cleaned under this section and painted with one coat of enamel paint under PAINTING SECTION 09900. Color of piping shall be selected by University Representative. Hangers and supports shall be coated by dipping or brush painting with one coat of asphalt varnish. Steel frame equipment supports shall be cleaned and painted with one coat of aluminum paint.
- C. Detached motor controllers, disconnects, etc., shall be identified with metal or plastic plates with etched letters to completely identify service of electrical equipment.
- D. Major control and sectionalizing valves shall be identified by means of etched brass plates bracketed to valve handle. Contractor shall prepare schedule of such identifying plates for University Representative's approval.

PART 3 - EXECUTION

3.1 FLASHING AND COUNTERFLASHING

All pipes and ducts that pass through roof and walls shall run so as not to interfere with the structural system and to permit proper application of base and counterflashing.

3.2 CLEANING, STERILIZING AND PIPING

- A. When all work has been finally tested, Contractor shall clean all pipes and exposed work.
- B. All pipes shall be free from all obstructions.
- C. All plated and other finished products shall be thoroughly cleaned and polished.

- D. All piping shall be installed so that it may expand and contract freely without damages to equipment, other work, or injury to piping system. All necessary swing joints, expansion joints, or offsets to protect piping, etc., shall be installed whether indicated or not. Piping shall be graded to allow for system drainage.
- E. All piping shall be installed and sized as indicated on plans and be of equivalent materials to piping as hereinafter specified.
- F. All piping shall be installed with runs arranged parallels or perpendicular to walls and ceilings with symmetrical and equal spacings between parallel pipes. Offsets shall be made using factory fittings, bending of piping shall not be accepted.
- G. Notify University Representative a minimum 72 hours prior to enclosing piping in concealed spaces so that piping may be inspected.

3.3 TESTING AND INSTRUCTION

- A. Piping shall be tested to pressure hereinafter specified. Where pressures are not mentioned, it shall be understood that testing to 1-1/2 times service conditions, before insulation is applied, will be acceptable. All tests shall be held for a minimum of 24 hours before inspection.
- B. Furnish all necessary gauges, pumps, test plugs, and temporary connections and shall test sections of the building as work progresses.
- C. All new chilled water piping shall be tested to 150 PSI for a period of four hours.
- D. All tests shall be made in the presence of the University Representative or his representative. Where pipes or connections in new piping are found to leak, they shall be made tight and the tests repeated.

3.4 CUTTING AND PATCHING

Cooperate to the fullest extent with all other trades to reduce to a minimum the amount of cutting and patching of other work necessary for this installation. Do not cut or patch the work of other trades but arrange to provide cutting templates in time, or otherwise pay the respective other contractors for changing theirs, to accommodate this work. No cutting into any structural units likely to impair the strength shall be done without the approval of the University Representative.

3.5 CLEAN UP

Remove debris, surplus and waste materials, oil, grease or stains resulting from the work performed and leave the premises in a broom clean condition **AT THE END OF EACH WORKING DAY**. All debris, surplus and waste material shall be removed completely from the job site.

3.6 WELDING

A. Codes and Standards

1. American Society of Mechanical Engineers (ASME) B31.1
2. ASME Boiler and Pressure Vessel Code – Section V and IX

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3. American Welding Society (AWS) D10

- B. Qualifications for Welding Work: The fabricator and/or installer shall qualify each welder or welding operator for the welding processes to be used during production and field welding. The performance qualification shall be in accordance with a qualified Welding Procedure Specification (WPS). The WPS shall be governed by the essential variables listed in ASME Section IX and AWS D10.9 as may be applicable for the welding processes for which the welder is being qualified. Provide certification that the welders performing work on this project are qualified in accordance with the WPS, as well as the parameters used in the qualification.
- C. Welds shall be in accordance with ASME and AWS standards as qualified under ASME Section IX. Owner shall employ a testing agency to perform a visual inspection of 5% of the welds in accordance with ASME Section V. The following visual examination indications shall be deemed unacceptable and shall be corrected at Contractor's expense:
1. Cracks on external surfaces
 2. Surface undercut greater than 1/32 inch deep
 3. Weld reinforcement greater than specified in ASME Table 127.4.2
 4. Lack of fusion on surface
 5. Incomplete penetration

Future inspections for failed welds shall be tested at Contractor's expense.

3.7 COMMISSIONING

- A. Contractor shall install all items of equipment as identified in this specification in strict accordance with manufacturer's requirements (whether identified in this specification or not), shop drawings and contract documents. Start-up of all equipment shall be by manufacturer authorized representative, unless specific equipment is allowed in writing, by the University Representative, to be started up by the installing Contractor. Start-up services shall be provided for as long a period of time as is necessary to insure proper operation of the equipment items. The start-up technician shall conduct all operating tests as required to insure the equipment is operating in accordance with design parameters. Complete testing of all safety and emergency control devices shall be made. The start-up technician shall submit a written report to the University Representative (prior to final punch list inspection) containing all test data recorded as required above and a letter certifying that the equipment is operating properly.
- B. Other specific items of commissioning shall be as follows:
1. Visually inspect insulation system to verify that insulation is continuous and vapor barrier is complete. Verify there is no condensation or hot spots, correct as required.
 2. Thoroughly test all piping systems to insure no leaks are present. Adjust valves, pressure reducing valves, etc., as required by operating characteristics of the system. Set pressures of domestic water systems.
 3. Vibration isolation shall be tested by running equipment and checking deflection of spring isolators. Make adjustments as required. No isolator shall be fully compressed.
 4. Piping shall be checked to insure direction of flow.

5. Coordinate with section 15950 Contractor to insure mechanical systems operate in accordance with plans and specifications. Heating and cooling modes shall be tested.
6. Ductwork and hydronic piping test and balancing. See Section 15850.
7. Provide written reports for all startup and commissioning tests for University Representative review prior to final punch list inspection.

END OF SECTION 15050

SECTION 15250 - INSULATION

PART 1 GENERAL

1.1 WORK SPECIFIED HEREIN

- A. Furnish all labor, materials, equipment and services necessary for the installation of all insulation as herein described and as indicated on the drawings. The insulation shall be applied by a licensed Insulation Contractor in strict accordance with the best practices of the trade. All insulation material, coverings, adhesive, vapor barriers and tapes shall have a flame spread classification not to exceed 25 and a smoke development not to exceed 50.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Certain items in this specification are listed by manufacturer and/or manufacturer's model number to establish general style, type, character, and quality of the product desired. Similar items manufactured by other than those listed will be considered, providing submittals are made according to Pre-Bid Approval requirements of Instructions to Proposers Article 3.3.
- B. Where no manufacturer or model number is given, any product meeting performance or design criteria, or referenced trade association standard may be used and Pre-Bid Approval is not required.

2.2 CHILLED WATER PIPING INSULATION

- A. All chilled water piping and fittings, including field insulation of chilled water packaged pumping system, shall be insulated with 100% rigid cellular glass molded pipe insulation. Insulation shall have an average density of 8 lb./cu.ft. and shall have a thermal conductivity of 0.31 BTU-in/hr.sf.degrees F. at 50 degrees F. The insulation shall comply with ASTM C 552, Type II furnished in half sections of 24" long. At Contractor's option insulate with 2" thick elastomeric closed cell foam pipe insulation. The R-value shall be 5.7 minimum. Coat the exterior with one coat of vapor retarder mastic suitable for use with elastomeric foam insulation.
- B. Insulation shall be installed with all seams and joints sealed with water proof sealant as recommended by the manufacturer. After sealant is applied insulation shall be secured with 1/2" wide by 0.010" thick stainless steel bands with matching seals. Sealants shall be applied full depth of all joints and shall not be used to fill voids or cracks.
- C. Cover all new insulation with an all purpose jacketing of kraft paper/aluminum foil/vinyl coating construction.
- D. Insulate fittings, flanges and valves with same material and thickness as adjacent piping. Cover insulation with same jacket as adjacent piping.
- E. Insulation shall have the following thickness:

Pipe Size	Insulation Thickness
Up to 1"	2"
1-1/4" to 4"	2-1/2"
5" to 12"	3"

- F. Provide one or two layer expansion/contraction joints in accordance with manufacturer's recommendations.

2.3 DUCT INSULATION

- A. DUCT SIZES SHOWN ON DRAWINGS ARE FREE AREA SIZES. See Section 15800 for insulation and duct material and type required for each application. Insulation shall be as per the following:
- B. Lined Duct system - All lined ducts shall be lined with Knauf Duct Liner E-M, Manville Lina-Cooustic ductliner, or approved equal. Duct Lining shall be applied in strict accordance with the latest edition of SMACNA's "HVAC Duct Construction Standard Metal & Flexible." Mechanical fasteners shall meet "Standards for Mechanical Fasteners MF-1-1975." Length of mechanical fasteners shall not compress the insulation more than 1/8" and shall be installed perpendicular to the duct surface. Adhesive shall conform to ASTM C 916 and be applied to the sheet metal with a 90% minimum coverage. All exposed edges of the duct liner material shall be coated with the same adhesive. All rips and tears shall also be repaired using adhesive. All internal duct areas shall be covered with duct liner. Transverse joints shall be firmly butted with no gaps, and coated with adhesive. Longitudinal corner joints shall be overlapped and compressed. For velocities from 4001 to 6000 FPM, metal nosing shall be applied to all upstream transverse edges to additionally secure the insulation." Liner shall be 1" thick, 1.5 PCF.

Exterior Duct Wrap - Exterior insulation duct wrap shall be 2" thick .75 PCF fiberglass wrap with F.S.K. jacket, KNAUF duct wrap, or approved equal.

2.4 HEATING WATER PIPING INSULATION

- A. Insulate pipe with glass fiber pipe insulation with factory applied white all service jacket, with self-sealing lap (ASJ-SSL) as manufactured by KNAUF, Manville or approved equal.
- B. Insulate fittings, flanges and valves with performed insulation with PVC premolded one-piece fitting covers, with fiberglass inserts, Proto covers, or approved equal. Premolded or shop fabricated glass fiber cover may be used in lieu of above at the Contractor's option. Optional covers to be given a smoothing coat of finishing cement in exposed areas and finished in all areas with Insulation Coating, Foster 30-35, Manville Duramesh No. 206 or approved equal, reinforced with white glass fabric.
- C. Insulation thickness to be as follows:

		PIPE SIZE	
		2-1/2 to 4"	Over 4"
Up to 2"			
Insulation Thickness	1"	1-1/2"	2"

- D. Adhere longitudinal laps and butt strips of jacket with factory applied pressure sensitive tape system, as manufactured by KNAUF, Manville or approved equal, or stapled on 2-inch centers with monel staples.
- E. Provide inserts of calcium silicate pipe insulation, at each pipe saddle and finish to match adjoining pipe insulation.

PART 3 EXECUTION

3.1 WORKMANSHIP AND INSTALLATION

- F. All insulation shall be applied per manufacturer's specifications and installation requirements.
- G. Insulation shall be applied over clean dry surfaces after all test have been performed and approved.
- H. Methods of application and other details not specified herein shall be in accordance with manufacturer's recommendations, which shall constitute minimum standards.
- I. Sheet Metal Saddles - 10" long shall be provided on all hangers supporting insulated lines. They shall be fabricated to conform with the outside diameter of the pipe covering and shall be fabricated from 22 gauge sheet iron for pipe through 2-1/2" 20 gauge sheet iron for pipes through 8" and 16 gauge for all pipes over 8".
- J. A rigid insulation material shall be used at each pipe hanger as an insert and the pipe covering shall pass full thickness through the hangers.

END OF SECTION 15250

SECTION 15800 - MECHANICAL SYSTEMS AND PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements apply to the work specified in this Section.
- B. Refer to General Piping Requirements which shall apply to work in this Section.

1.2 DESCRIPTION OF WORK

- A. The work to be done under this Section includes the furnishing of all labor, tools, materials, equipment and services necessary for and reasonable incidental to the removal and installation of complete mechanical equipment and piping as shown on plans and herein specified, excepting only work and/or materials indicated as being done and/or furnished under other sections.
- B. Contractor shall refer to other Sections of the Specifications which may be applicable to, or associated with this Section.
- C. Contractor shall disconnect and remove the Mechanical equipment as shown on the drawings.
- D. Contractor shall provide complete installation of piping, equipment and installation of all field mounted accessories.
- E. Miscellaneous piping.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Provide and install structural supports for equipment. These supports must be checked and coordinated by this Section so that they suit the equipment which is to be supported.
- B. Provide all platforms slabs, lintels and curbs, as directed by this Section, to accommodate the mechanical equipment.

1.4 QUALITY ASSURANCE

These specifications with accompanying drawings, require complete apparatus, fully erected and in successful operating condition. Perform all work in best, most substantial manner.

1.5 SUBMITTALS

- A. Contractor, before beginning work, shall submit dimensional shop drawings for approval of the installation of all piping systems and equipment layouts.
- B. Where the piping installed is of a different configuration and/or routing than that shown on the drawings, Contractor shall assume all responsibility to conform with the intent of the contract documents. The University Representative shall be advised of any changes and deviations for his approval. The same shall be true for any field modification required because of "on job" construction conditions.

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PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Certain items in this specification are listed by manufacturer and/or manufacturer's model number to establish general style, type, character, and quality of the product desired. Similar items manufactured by other than those listed will be considered, providing submittals are made according to Pre-Bid Approval requirements of Instructions to Bidders Article 3.3.
- B. Where no manufacturer or model number is given, any product meeting performance or design criteria, or referenced trade association standard may be used and Pre-Bid Approval is not required.

2.2 PIPING AND FITTINGS

- A. Furnish and install all piping related to the mechanical equipment and other miscellaneous piping.
- B. All piping shall be installed parallel and square with building lines and shall be sloped to permit drainage, with suitable provision for drainage at all low points.
- C. Piping shall be arranged to maintain headroom and keep passageways clear and where necessary shall be offset to maintain the required clearance and conform with the structural features of the building. Contractor shall determine in advance of construction locations for all piping sleeves, hangers, etc. No allowance will be made for extra due to inaccurate location of sleeves, piping or equipment.
- D. All piping shall have provisions for expansion and contraction with anchorage at each point shown on the plans and/or as required.
- E. Full length pipe shall be used where possible, short lengths and couplings will not be permitted. After cutting, all pipes shall be reamed out to full bore and before erection, all cutting and foreign matter shall be removed from the inside of pipes. Screwed joints shall be made tight without caulking or the use of lead or paint and no lubricant shall be used except flake granite and cylinder oil paste, or approved pipe compound applied to make threaded pipe.
- F. Pipe sleeves shall be provided for the passage of all pipe through walls, floors and partitions.
- G. Welding fittings shall be Tube Turn, Midwest, or approved equal. Use welding elbows at all turns in welded piping, except where bent runs are indicated and except that turns and off-setting to a maximum of 15 degrees mitered. At branch connections, use welding tees.
- H. Hydronic piping shall be installed using ASTM A53 Grade B Schedule 40 black steel pipe with welded fittings. Welded elbows shall be factory made long radius.
- I. Water and drain piping 2" and smaller shall be ASTM B88 type "L" hard drawn copper with wrought copper sweat fittings.
- J. Install control valves, sensor wells, sockets, flow meters and DP sensors required by Section 15950. Provide brass nipples for all sensor wells.

MECHANICAL SYSTEMS AND PIPING

2.3 PAINTING AND IDENTIFICATION

- A. Equipment factory fabricated and assembled units shall be furnished with factory applied protective prime coat paint of finished baked enamel. Equipment surfaces damaged during course of construction or shipment shall be refinished by the Contractor.
- B. Detach motor controllers, disconnects, etc., shall be identified with metal or plastic plates with etched letters to completely identify service of electrical equipment.
- C. Major control and sectionalizing valves shall be identified by means of etched brass plates bracketed to valve handle. Contractor shall prepare schedule of such identifying plates for Engineer's approval.
- D. All piping at all equipment shall be stenciled to show the service and direction of flow. Stencils shall be black on a white background with letters one (1") inch high spaced at approximately forty-eight (48") inches apart. Pressure-sensitive pipe markers ANSI Standard A 13.1-1956 may be used in lieu of stenciling.
- E. Paint all piping and equipment in accordance with Painting Section 09900.

2.4 WATER TREATMENT

- A. Water treatment chemicals shall be furnished and installed by the University.
- B. This contractor shall completely flush out the systems to remove all oil and film from the inside of the piping.

2.5 VIBRATION ISLOATION SYSTEMS

- A. Work shall include furnishing, installing and testing all material required and hereinafter called for complete execution of the vibration isolation system. Isolation materials shall not be limited to compressors, converters, air units, pumps, piping, duct work, fans, etc. All motor-connected equipment shall be considered a source of vibration and shall be isolated to prevent vibration and sound transmission. Isolation equipment, as manufactured by Kinetics, Mason industries or prior approval equal, shall be used. Specific reference to isolation under equipment headings is to provide additional information by which proper selection of the required isolation may be made. Equipment specification data showing physical size, bearing points, weights per point, rotating speeds and sound power levels generated shall be furnished by the respective equipment supplier to the vibration isolation supplier after equipment submittals have been approved.
- B. All mechanical and sound isolation materials specified herein or shown on drawings shall be provided by a single manufacturer to assure singular responsibility for proper selection, application, installation and performance. Substitution for isolation material specified incorporating non-permanent materials, such as cork, rubber, wood pulp, or thermal fiberglass will not be acceptable. Should no specific material be called out for particular use, all mechanical vibration isolation shall be based upon Chapter 46, 1999 A.S.H.R.A.E. Guide-Table 45, "Guide for Selection of Vibration Isolators". Bases, mounts, and hangers furnished shall have anominal deflection equal to the minimum deflection as shown in this guide and shall be furnished on all motor driven equipment requiring isolation as well as piping and duct connected to same.

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- C. To assure stability, the spring element to be a large diameter laterally stable spring with load plate and have a lateral stiffness greater than 0.8 times the rater vertical stiffness and be designed to prove up to 50% overload capacity. Each base mount spring shall have a 1" isolation sound pad of elasomeric material.
- D. Isolation shall be stable during starting and stopping of equipment without any transverse or eccentric movement that could damage or adversely affect the equipment or attachments. Isolation systems for floor or ceiling-mounted equipment shall have a maximum lateral motion under start up and shut down of 3/8". Motion in excess shall be corrected by restrained spring-type mounts. Isolators shall be selected for the lowest operating speed of the equipment isolated and shall be located to produce uniform loading and deflection even when equipment weight is not evenly distributed. Static deflection on grade up to 3/8" shall use nominal 1" deflection springs on isolation pads. Static deflection above grade shall use spring isolators with spring deflection based upon 2007 ASHRAE Handbook Deflection data. The static deflection of the isolation system shall be selected to avoid being in resonance with the disturbing frequency. All spring isolators shall have neoprene sound damping pads separating isolator from structure.
- E. Submittals shall contain a complete schedule of all equipment to be isolated along with the type of isolator, loading per isolator, static deflection, spring diameters and maximum deflection. Should isolation installed fail to perform satisfactorily in preventing the transmission of vibration, the isolation shall be replaced without cost to owner and properly selected isolators shall be installed.

2.6 HVAC DUCTWORK

- A. Provide and install a complete system of ductwork as herein specified to include, but not limit to supply, return, exhaust and fresh air with grilles, registers, diffusers and appurtenance to provide a complete functional and operational system. Duct sizes shown on drawings are free area dimensions. Design shall be as described in the latest edition of SMACNA manuals and as per the following:
 - 1. Galvanized sheet metal shall be lock form quality per ASTM A653 with a G90 zinc coating.
 - 2. Outside air and exhaust air ducts shall be galvanized sheetmetal with air-tight seams and as per applicable sections of SMACNA manuals for low velocity ducts. Insulate outside air and exhaust air ducts with 2" exterior duct wrap as per SECTION 15250.
 - 3. Supply and return ducts for low pressure system and, low velocity systems shall be galvanized sheetmetal with airtight seams and as per applicable section of SMACNA manuals for low velocity ducts. All ducts shall be insulated with 2" exterior wrap as per Section 15250.
 - 4. Rectangular ductwork for medium pressure, high velocity systems shall be galvanized sheetmetal with airtight seams and as per applicable section of SMACNA manuals for high velocity ductwork. Insulate with 2" exterior duct wrap as per Section 15250.
 - 5. Round rigid ductwork shall be all round single wall spiral pipe and fittings, galvanized steel, as per applicable sections of SMACNA manuals for high velocity duct. Insulate with 2" exterior duct wrap as per Section 15250. Seal all seams, joints and wall penetrations with hardcast as herein specified.

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6. All ducts shall be sealed per SMACNA Seal Class A. All joints, longitudinal seams and wall penetrations of all supply, return outside air and exhaust ducts shall be sealed with an elastomeric tape which shall consist of a pressure sensitive layer of modified butyl rubber sealer laminated to a foil backing material which shall conform to surface variations and irregular areas and shall not harden crack or peel. The sealant shall be waterproof and shall be a minimum of 15 mils thick. All ductwork shall be cleaned and prepared and sealant shall be applied strictly in accordance with manufacturer's instructions and recommendations. Sealant shall be Hardcast FG-1402, Suretape #653 or approved equal, at Contractor's option flanged gasketed duct system may be used for POSITIVE PRESSURE SYSTEM ONLY.
 7. Flexible round duct where indicated on plans shall be listed by Underwriters' Laboratories, Inc., under UL-181 standards as Class I flexible Air Duct Material complying with NFPA Standards 90A. Ducts shall be rated on maximum pressure of 6 inches WG positive and 2 inches WG negative. The duct shall be factory fabricated assembly composed of: an inner duct of woven and coated fiberglass providing an air seal and bonded permanently to corrosion resistant coated steel wire helix: a 2" thick fiberglass insulating blanket and low permeable outer vapor barrier of fiberglass reinforced metalized film laminate. Pressure drop not to exceed .15" SP at 500 Fpm through 6" or larger duct. Maximum length of flexible duct shall not exceed 8'-0". Connect flexible round duct with ½" wide nylon positive locking nylon straps on inner duct and outer duct.
 8. Splitter dampers shall be installed where branches take off of main trunk ductwork, where ducts divide or where shown on the drawings. Splitters shall be fitted with nickel plated damper regulators in finished areas. Splitters shall be factory fabricated in accordance with SMACNA Duct Construction Standards.
- B. Flexible connections shall be provided between each fan unit and ductwork on supply side and also on return side. Material shall be flexible fire-resistive material, minimum 4" wide, UL listed, with no metal to metal contact.
- C. Duct supports for rectangular ducts shall be a minimum 1" X 18 gauge galvanized steel bands. Hanger bands shall be bent under lower corners and secured with self-tapping screws at corners and six (6") inch intervals up the sides. Distance between hangers shall be as recommended by SMACNA manual for low and medium ductwork. Ductwork shall be rigidly supported to prevent vibration. Duct attachments to structure, lower hanger attachments, ducts traps and rods and trapeze angles shall be in accordance with SMACNA Low Pressure and High Pressure Duct Standards.
- D. Where the ducts pass through walls, draftstops or partitions, the space shall be packed with non-combustible materials, filling all voids around duct.
- E. Fire dampers with fusible links shall be installed at all points in ductwork where indicated on drawings, and/or as required by NFPA, 90-A, AND MECHANICAL CODE OF THE IBC.
- F. Provide radius elbows unless specifically indicated otherwise or space prohibitive. Rectangular radius elbows shall be factory fabricated with a centerline radius of not less than the width of the duct. Round duct elbows shall have a minimum center line radius of 1-1/2 times the diameter of the duct and shall be smooth where possible. Provide square elbows where indicated or space

prohibits the use of radius elbows. Square elbows shall be factory fabricated with double thickness airfoil turning vanes pre-assembled and securely attached to runners.

- G. In general, vertical risers and other duct runs, where the method of support specified above is not applicable, or not specifically detailed on drawings, shall be supported by substantial angle brackets designed to meet field conditions, installed to allow for duct expansion and approved by Architect.
- H. Provide exposed operators for operation of dampers and splitters in inaccessible ceilings, operators shall be chrome plated.
- I. Maximum duct leakage shall be +/- 5%, SMACNA Seal Class A. Ductwork shall be designed for 4.0" static pressure. Outside air, return air and exhaust air systems shall be designed for 4.0" static pressure. Construct ductwork in accordance with SMACNA Duct Construction Standards for the specified pressure class.
- J. Install Automatic dampers, airflow stations and other duct mounted devices required by Section 15950.
- L. Flanged gasketed exhaust and return ductwork will not be accepted.

2.7 FIRE DAMPERS

Fire dampers shall be solid sheet curtain type, dynamic closure type corrosion resistant galvanized steel construction. Dampers mounted in the horizontal position shall be closed by a stainless steel negate spring. Damper to be easily reset through standard access panel for required periodic maintenance. Access panels are required for access to all fire dampers, minimum size 12 X 12 inches. Dampers shall be 100% out of air stream. Provide fusible links rated at 160 degrees F.

2.8 ACCESS DOORS

Access doors shall be installed in ductwork wherever required for ready access to any operating part. Doors shall not be smaller than 12 X 12 inches, with brass hinge and sash type fasteners. Ducts 30" or larger shall be supplied with minimum 18 X 18 inch access doors. Doors shall be double wall insulated type, hinged with sash locks and gaskets.

2.9 AIR HANDLING UNITS

Provide custom indoor air handling units as manufactured by Temtrol as the basis-of-design. Equipment manufactured by Webco, Ventrol or Huntair shall be considered provided the construction specifications capacities and performance criteria are met.

GENERAL

Furnish and install where shown on the plans, mechanical frame style air handling units with construction features as specified below. The units shall be provided and installed in strict accordance with the specifications. All units shall be complete with all components and accessories as specified.

Any exceptions must be clearly defined. The contractor shall be responsible for any additional expenses that may occur due to any exception made.

Factory Testing and Quality Control

Standard Factory Tests: The fans shall be factory run tested to ensure structural integrity and proper RPM. All electrical circuits shall be tested to ensure correct operation before shipment of unit. Units shall pass quality control and be thoroughly cleaned prior to shipment.

UNIT CONSTRUCTION DESCRIPTION

General: Provide factory-fabricated air handling units with capacity as indicated on the schedule. Units shall have overall dimensions as indicated and fit into the space available with adequate clearance for service as determined by the Engineer. Units shall be completely assembled. Multiple sectioned units shall be shipped as a single factory assembled piece (except where shipping limitations prevent) de-mounted into modular sections in the field by the contractor. Units shall be furnished with sufficient gasket and bolts for reassembly in the field by the contractor. Unit manufacturer shall provide certified ratings conforming to the latest edition of AMCA 210, 310, 500 and ARI 410. All electrical components and assemblies shall comply with NEMA standards. Unit internal insulation must have a flame spread rating not over 25 and smoke developed rating no higher than 50 complying with NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems." Units shall comply with NFPA 70, "National Electrical Code," as applicable for installation and electrical connections of ancillary electrical components of air handling units. Tags and decals to aid in service or indicate caution areas shall be provided. Electrical wiring diagrams shall be attached to the control panel access doors. Operation and maintenance manuals shall be furnished with each unit. Units shall be UL or ETL listed.

Rigging Provision – Multiple Piece Units: Units shipped in multiple sections shall be engineered for field assembly. The base frame shall have integral lifting lugs. The lifting lugs shall be fabricated from structural steel with an appropriate rigging hole. Lifting lugs shall be located at the corner of each section (and along the sides if required) and sized to allow rigging and handling of the unit. All gasket and necessary assembly hardware shall ship loose with unit. Junction boxes with a factory supplied numbered terminal strip shall be supplied at each shipping split for reconnection of control wiring.

Unit Base - Floor: Unit perimeter base shall be completely welded and fabricated using heavy gauge structural steel tubing. (Note: bolted bases are not acceptable) C-Channel cross supports shall be welded to perimeter base steel tubing and located on maximum 24" centers to provide support for internal components. Base rails shall include lifting lugs welded to perimeter base at the corner of the unit or each section if de-mounted. Entire base frame is to be painted with a phenolic coating for long term corrosion resistance. Internal walk-on floor shall be 16 gauge galvanized steel. The outer sub-floor of the unit shall be made from 20 gauge galvanized steel. The floor cavity shall be spray foam insulated with floor seams gasketed for thermal break and sealed for airtight / watertight construction. Where access is provided to the unit interior, floor openings shall be covered with walk on phenolic coated steel safety grating. Single wall floors with glued and pinned insulation and no sub floor are not acceptable. Base frame shall be attached to the unit at the factory.

Unit Casing – The construction of the air handling unit shall consist of a (1" x 2") steel frame with formed 16 gauge galvanized steel exterior casing panels. The exterior casing panels shall be attached to the gasketed (1 x 2) steel frame with corrosion resistant fasteners. All casing panels shall be

completely removable from the unit exterior without affecting the unit's structural integrity. (Units without framed type of construction shall be considered, provided the exterior casing panels are made from 14 gauge galvanized steel, maximum panel center lines are less than 20 inches and deflection is less than $L/200 @ 9''$ positive pressure). The air handling unit casing shall be of the "no-through-metal" design. The casing shall incorporate insulating thermal breaks as required so that, when fully assembled, there's no path of continuous unbroken metal to metal conduction from inner to outer surfaces. Provide necessary support to limit casing deflection to $L/200$ of the narrowest panel dimension. If panels cannot meet this deflection, additional internal reinforcing is required. All panel seams shall be caulked and sealed for an airtight unit. Leakage rates shall be less than 1% at design static pressure or 9" W.C. whichever is greater.

Double Wall Liner - Each unit shall have double wall construction with 20 gauge solid galvanized liner in the entire unit. The double wall interior panel shall be removable from the outside if the unit without affecting the structural integrity of the unit.

Insulation - Entire unit to be insulated with a full (R20) 3" thick closed cell foam insulation. Foam shall be ecomate 0-, 0-, (Non VOC) UL 94HF1 rated. All insulation edges shall be encapsulated within the panel. All field penetrations must be completely sealed by installing contractor.

Note: Non UL 94HF1 rated foam is not allowed.

Access Doors - The unit shall be equipped with a solid double wall insulated (same as the unit casing), hinged access doors as shown on the plans. The doorframe shall be extruded aluminum, foam filled with a built in thermal break barrier and full perimeter gasket. The door hinge assembly shall be completely adjustable die cast stainless steel. There shall be a minimum of two heavy duty handles per door. Provide ETL, UL 1995, and CAL-OSHA approved tool operated safety latch on all fan section access doors.

Supply fans - shall be double width, double inlet, class II, direct-drive type housed airfoil fan dynamically balanced as an assembly. Maximum fan RPM is always below the first critical fan speed.

Heat Transfer Coils – Water Coil

1. All coil assemblies shall be leak tested under water at 315 PSIG and PERFORMANCE is to be CERTIFIED under ARI Standard 410. Coils exceeding the range of ARI standard rating conditions shall be noted.
2. Cooling coils shall be mounted on stainless steel support rack to permit coils to slide out individually from the unit. Provide intermediate drain pans on all stacked cooling coils. The intermediate pan shall drain to the main drain pan through a copper downspout. Water coils shall be constructed of seamless copper tubing mechanically expanded into fin collars. All fins shall be continuous within the coil casing to eliminate carryover inherent with a split fin design. Fins are die formed Plate type.
3. Headers are to be seamless copper with die formed tube holes.
4. Connections shall be male pipe thread (MPT) Schedule 40 Red Brass with 1/8" vent and drain provided on coil header for coil drainage. All coil connections shall be extended to the exterior of the unit casing by the manufacturer. Coils shall be suitable for 250 PSIG working pressure. Intermediate tube supports shall be supplied on coils over 44" fin length with an additional support every 42" multiple thereafter.

5. Water coils shall have the following construction:

:

5/8" o.d. x .020" wall copper tube with .028 return bends.
.008" aluminum fins
16 gauge stainless steel casing

Condensate / Drain Pans - IAQ style drain pans shall be provided under all cooling coils as shown on the drawings. The drain pan shall be fabricated from 16 gauge 304 stainless steel. All pans are to be triple pitched for complete drainage with no standing water in the unit. They shall be insulated minimum 3-inch "Double Bottom" construction with welded corners. Provide stainless steel, 1-1/4" MPT drain connection extended to the exterior of the unit base rail. Units in excess of 159 inches shall have drain connections on both sides. All drain connections shall be piped and trapped separately for proper drainage.

Filters - Provide filters of the type indicated on the schedule. Factory fabricated filter sections shall be of the same construction and finish as the unit. Face loaded pre and final filters shall have Type 8 frames as manufactured by BLC, FARR or equal. Filter racks over 72" in length shall require an angle center reinforcement support. Side service filter racks shall be fabricated from no less than 16 gauge galvanized steel and include hinged access doors on both sides of the unit or as indicated on unit drawings. Internal blank-offs shall be provided by the air unit manufacturer as required to prevent air bypass around the filters.

1. Filter Gauge: Each Filter bank shall be furnished with Dwyer Series 2000 filter gauge or equal.
2. Medium Efficiency Pleated filters – Provide 2" pre-filter and 4" MERV 13 filter The filters shall be as manufactured by AAF, FARR or equal. Filters shall be in compliance with ANSI/UL 900 – Test Performance of Air Filters.

ELECTRICAL POWER AND CONTROLS

All electrical and automatic control devices not previously called out or listed below are to be furnished and installed in the field by OTHERS.

All wiring shall be (75°C) Insulated copper wires.

The unit shall feature a mounted permanent nameplate displaying at a minimum the manufacturer, serial number, model number and current and amps voltage. The unit must have an ETL or UL Listing and bear the appropriate mark.

Conduit shall consist of a combination of EMT or flexible metal conduit as required. Liquidtight flexible metal conduit may be used outside the air tunnel for wet locations.

Unit Convenience Features

1. Each section shall be equipped with a vapor- proof 100 watt service light with guard.
2. Lights shall be controlled by one light switch mounted adjacent to the supply air fan access door.

3. Furnish a 120 volt GFI duplex convenience outlet on the exterior of the unit as indicated on the unit drawing.

All motors shall be standard foot mounted type TEAO selected at the specified operating voltage, RPM, and efficiency as specified or as scheduled elsewhere. Motors shall meet the requirements of NEMA MG-1 Part 30 and 31, section 4.4.2. Motors shall be as manufactured by Baldor, Siemens, or Toshiba for use in multiple fan arrays that operate at varying synchronous speeds as driven by an approved VFD. Motor HP shall not exceed the scheduled HP as indicated in the AHU equipment schedule(s). Steel cased motors and/or ODP motors are not acceptable. All motors shall include permanently sealed (L10-400,000 hr) bearings and AEGIS™ shaft grounding to protect the motor bearings from electrical discharge machining due to stray shaft currents. Each fan/motor assembly shall be dynamically balanced to meet AMCA standard 204-96, exceeding category BV-5, to meet or exceed an equivalent Grade G.55, producing a maximum rotational imbalance of .022" per second peak, filter in (.55mm per second peak, filter in). Fan and motor assemblies submitted for approval incorporating larger than 22" wheel size and 215 T frames size motors shall be balanced in three orthogonal planes to demonstrate compliance with the G.55 requirement with a maximum rotational imbalance of .022" per second peak filter in (.55 mm per second peak, filter in). Copies of the certified balancing reports shall be provided with the unit O&M manuals at the time of shipment. Submittals that do not include a statement of compliance with this requirement will be returned to the contractor without review.

2.10 UVC FIXTURE

- A. Lamps and fixtures shall be installed in new AHU in sufficient quantity and in such a manner so as to provide an equal distribution of UVC energy. When installed, the average intensity striking the intended surface shall not be less than 200 microwatts per square centimeter. The applied energy and its distribution average shall be verified using third party math modeling and that verification shall be included with the submittal.
- B. The minimal UVC energy striking a surface shall be sufficient to continuously destroy a mono-layer of mold and bacteria as typically found in HVAC systems in less than six hours. The third party mathematical modeling shall include the destruction time for at least four of the most common HVAC microbes and an energy distribution map.
- C. Fixture rows shall be electrically terminated to factory supplied Hard Wire Boxes to meet UL and local electrical codes. Fixtures shall be mounted to irradiate the intended surfaces as well as all of the available line of sight airstream by proper placement and incident angle reflection. Third party irradiation and intensity calculations (modeling) shall determine fixture placement and energy distribution and shall be provided in the submittal.
- D. Fixtures shall be track mounted to the appropriate factory supplied hardware to form horizontal rows that provide for the proper fixture support. Fixtures shall be equipped with UL approved fixture-to-fixture mechanical and electrical connections that facilitate proper installation and coupling to A/C power from one end. Fixtures shall be capable of being mounted anywhere in the system and/or as shown on the plans.
- E. When used for surface irradiation, the fixture assembly shall be designed and installed such that the sum of the lamp arc lengths in a row shall be equal to a minimum of 90% of the surfaces total width.

- F. Fixtures shall meet the “UL” drip proof design and each fixture shall be equipped with an electrical interlock, which will not allow the fixture to energize unless it’s properly installed to its factory supplied mounting track.
- G. Fixtures shall be constructed of type 304 stainless steel to preclude corrosion.
- H. Power supplies shall be of the high efficiency electronic type, matched to the lamp and designed to maximize UVC photon production, radiance and reliability. They shall be UL Listed and labeled for use in air-streams of 55-135° F. They shall be capable of producing the specified output and organism destruction as specified under Irradiation and Intensity at no more than 13 Watts of power consumption for each square foot of treated, cross sectional plane.
- I. Each lamp shall contain no more than 8 milligrams of mercury, consistent with current environmental practices, while producing the specified output at 500 fpm in temperatures of 55-135° F. Useful lamp life shall be 9000 hours with no more than a 20% output loss at the end of one year of continuous use. They shall be constructed with UVC proof metal bases and shall not produce ozone.
- J. UVC Fixtures shall be stored in a clean, dry place and protect from weather and construction traffic. UVC Fixtures shall be handled carefully to avoid damage to components, enclosures and finish. Factory-shipping covers shall be left in place until installation is complete. Damaged components shall not be installed, instead replace them and return damaged components to equipment manufacturer.
- K. Installation of UVC fixtures
 - 1. Coordinate with installation of HVAC equipment and install Fixtures as indicated above after such equipment is properly installed.
 - 2. Comply with manufacturers’ installation instructions regarding wiring and testing and to the drawings and/or specification regarding exact fixture placement for proper energy distribution.
 - 3. Provide an interlock switch on all access panels and doors leading to the UVC assembly and/or within view of the fixtures to assure that the UVC assembly will be de-energized when any of these accesses are opened.
 - 4. When specified and/or called out on the drawings, install a relative indicating radiometer and adjust and set in accordance with manufacturer recommendations.
 - 5. Caution Labels shall be installed on all accesses to the Fixtures.
 - 6. Install UVC system on AHU 3-1..
- L. Fixtures shall be as manufactured by UltraViolet Devices, Inc., ALTRU•V Products or approved equal.

2.11 VARIABLE FREQUENCY DRIVES

- A. The VFD package as specified herein shall be enclosed in a UL Listed Type enclosure, (NEMA rated enclosures are not acceptable) completely assembled and tested by the manufacturer in an

ISO9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.

1. Environmental operating conditions: 0 – 40° C continuous. Altitude 0 to 3300 feet above sea level, up to 95% humidity, non-condensing. All circuit boards shall have conformal coating.
2. Enclosure shall be rated UL type 1 and shall be UL listed as a plenum rated VFD.

B. All VFDs shall have the following features:

1. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
2. The keypad shall include Hand-Off-Auto selections and manual speed control. There shall be fault reset and “Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.
3. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. The VFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings. Capacitor backup is not acceptable.
4. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).
5. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-pole motors.
6. The VFD shall have 5% equivalent impedance internal reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% equivalent impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFDs with only one DC reactor shall add an AC line reactor.
7. The VFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV’s (phase to phase and phase to ground), a capacitor clamp, and 5% equivalent impedance internal reactors.
8. The VFD shall provide a programmable proof of flow Form-C relay output (broken belt / broken coupling). The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

C. All VFDs to have the following adjustments:

1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.

2. Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter setpoints, etc. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain setpoint of an independent process (ie. valves, dampers, etc.). All setpoints, process variables, etc. to be accessible from the serial communication network.
 3. Two (2) programmable analog inputs shall accept current or voltage signals.
 4. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.
 5. Six (6) programmable digital inputs.
 6. Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable.
 7. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, time-clock control, or serial communications) the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close.
 8. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.
 9. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.
 10. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency without derating the VFD or operating at high carrier frequency only at low speeds.
 11. The VFD shall include password protection against parameter changes.
- E. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (LED and alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words.
- F. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):
- Output Frequency
 - Motor Speed (RPM, %, or Engineering units)

Motor Current
Drive Temperature
DC Bus Voltage
Output Voltage

- G. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fireman's control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed or operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlock, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation.

H. Serial Communications

1. The VFD shall have an RS-485 port as standard. The standard protocols shall be Modbus, BACnet, Johnson Controls N2 bus, and Siemens Building Technologies FLN. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.
 2. The BACnet connection shall be an RS485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
 - a. Data Sharing – Read Property – B.
 - b. Data Sharing – Write Property – B.
 - c. Device Management – Dynamic Device Binding (Who-Is; I-AM).
 - d. Device Management – Dynamic Object Binding (Who-Has; I-Have).
 - e. Device Management – Communication Control – B.
 3. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.
- I. EMI / RFI filters. All VFDs shall include EMI/RFI filters. The VFD shall comply with standard EN 61800-3 for the First Environment, restricted level with up to 100' of motor cables. No Exceptions. Certified test lab test reports shall be provided with the submittals.

- J. All VFDs through 60HP shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad. The VFD shall not be damaged by this condition.
- K. OPTIONAL FEATURES – Optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. The bypass enclosure door and VFD enclosure must be interlocked such that input power is turned off before either enclosure can be opened. The VFD and Bypass as a package shall have a UL listed short circuit rating of 100,000 amps and shall be indicated on the data label.
1. A complete factory wired and tested bypass system consisting of an output contactor and bypass contactor, service (isolation) switch and VFD input fuses are required. Bypass designs, which have no VFD only fuses, or that incorporate fuses common to both the VFD and the bypass will not be accepted
 2. Door interlocked padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.
- L. The following operators shall be provided:
- a. Bypass Hand-Off-Auto
 - b. Drive mode selector and light
 - c. Bypass mode selector and light
 - d. Bypass fault reset
 - e. Bypass LDC display, 2 lines, for programming and status / fault / warning indications
1. Motor protection from single phase power conditions - The Bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in Bypass mode are not acceptable.
 2. The system (VFD and Bypass) tolerated voltage window shall allow the system to operate from a line of +30%, -35% nominal voltage as a minimum. The system shall incorporate circuitry that will allow the drive or bypass contactor to remain “sealed in” over this voltage tolerance at a minimum.
 3. The Bypass system shall NOT depend on the VFD for bypass operation. The bypass shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the enclosure for repair / replacement.
 4. Serial communications – the bypass and VFD shall be capable of being monitored and or controlled via serial communications. Provide communications protocols for ModBus; Johnson Controls N2; Siemens Building Technologies FLN (P1) and BACnet in the bypass controller.
 5. BACnet Serial communication bypass capabilities shall include, but not be limited to; bypass run-stop control; the ability to force the unit to bypass; and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the DDC to monitor feedback such as, bypass current (in amps), bypass kilowatt hours (resettable), bypass operating hours (resettable), and bypass logic board temperature. The DDC shall also be capable of monitoring the bypass relays output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional bypass status indications and settings shall be transmitted over the serial communications bus – keypad “Hand” or “Auto” selected, and bypass selected.

The DDC system shall also be able to monitor if the motor is running under load in both VFD and bypass (proof of flow) in the VFD mode over serial communications or Form-C relay output. A minimum of 40 field parameters shall be capable of being monitored in the bypass mode.

6. Run permissive circuit - there shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, time-clock control, or serial communications) the VFD and bypass shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD system input and allows motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close.
7. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor operation shall be indicated on the Bypass LCD display as well as over the serial communications protocol.
8. The bypass control shall include a programmable time delay for bypass start and keypad indication that this time delay is in process. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 – 120 seconds.
9. The bypass control shall be programmable for manual or automatic transfer to bypass. The user shall be able to select via keypad programming which drive faults will generate an automatic transfer to bypass and which faults require a manual transfer to bypass.
10. There shall be an adjustable motor current sensing circuit for the bypass and VFD mode to provide proof of flow indication. The condition shall be indicated on the keypad display, transmitted over the building automation protocol and on a relay output contact closure.
11. The bypass controller shall have six programmable digital inputs, and five programmable Form-C relay outputs.
12. The relay outputs from the bypass shall be programmable for any of the following indications.
 - a. System started
 - b. System running
 - c. Bypass override enabled
 - d. Drive fault
 - e. Bypass fault
 - f. Bypass H-O-A position
 - g. Motor proof of flow (broken belt)
 - h. Overload
 - i. Bypass selected
 - j. Bypass run
 - k. System started (damper opening)
 - l. Bypass alarm
 - m. Over temperature
13. The digital inputs for the system shall accept 24VAC or 24VDC. The bypass shall incorporate internally sourced power supply and not require an external control power source. The bypass power board shall supply 250 ma of 24 VDC for use by others to power external devices.

14. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.
15. The user shall be able to select the text to be displayed on the keypad when the safety opens. Example text display indications include “Firestat”, “Freezestat”, “Over pressure” and “Low pressure”. The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.
16. Class 10, 20, or 30 (selectable) electronic motor overload protection shall be included.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All piping and equipment shall be installed in accordance with manufacturer's recommendations. Installation, adjustments and starting shall be done under supervision of manufacturer's representative.
- B. All piping and valves shall be installed in a neat and workmanlike manner in accordance with the guidelines and the best practice of the trade.
- C. Upon completion of the installation of all work and equipment the Contractor shall coordinate with the University in the starting of all equipment and make all necessary tests and adjustments to place the piping systems in a satisfactory condition for continuous safe operation of facilities.

END OF SECTION 15800

SECTION 15850 – TESTING AND BALANCING OF AIR AND HYDRONIC SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall furnish all labor, equipment and services necessary for and incidental to Air and Water Systems Testing and Balancing.
- B. The Contractor shall procure the services of an independent testing and balancing agency. The Testing and Balancing Agency (TBA) specializes in testing and balancing of heating, ventilating, air-moving equipment, air-conditioning system and Hydronic systems. The Contractor shall award the test and balance contract to the above agency as soon as possible after receipt of contract.
- C. Testing and Balancing shall not begin until the systems have been completed and are in full working order.
- D. Shop drawings must be provided to the TAB firm no later than 30 days after the final, approved shop drawings have been returned by the University Representative.
- E. Duct leakage testing shall be the responsibility of the TBA subcontractor.
- F. Fire and smoke damper testing shall be done by the contractor and witnessed by the TAB firm.
- G. The final and complete Test and Balance Report shall be submitted, for approval, not less than two weeks before a final inspection of the Project is requested by the General Contractor. Failure to provide the Report shall be cause to delay the final inspection until the Report is Approved .
- H. Contractor is cautioned that test and Balance Report shall include both Grille counts, and Supply, Return, Outside Air and Exhaust Duct Traverses so that duct leakage can be calculated.

1.2 REFERENCES

- A. AABC – National Standards for Total System Balance.
- B. NEBB – Procedural Standards for Testing, Adjusting, and Balancing.

1.3 SUBMITTALS

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- A. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- B. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for University Representative and for inclusion in operating and maintenance manuals.
- C. Provide reports in soft cover, letter size, binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating, thermostat locations.

1.4 QUALITY ASSURANCE

Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Standards – Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems or Testing Adjusting and Balancing Bureau (TABB)-National Standards for Environmental Systems Balance.

1.5 QUALIFICATIONS

TBA shall be a Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years experience.

PART 2 - PRODUCTS

2.1 ADJUSTMENT DEVICES

Replacement of adjustable pulleys, additional balancing dampers, additional fan belts, pressure taps and fitting, hydronic balancing valves and any other devices or equipment required to effect proper testing, adjusting and balancing shall be provided shall be provided by the Contractor at no additional cost to the University.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.

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4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 5. Duct systems are clean of debris.
 6. Fans are rotating correctly.
 7. Fire and volume dampers are in place and open.
 8. Air coil fins are cleaned and combed.
 9. Access doors are closed and duct end caps are in place.
 10. Air outlets are installed and connected.
 11. Duct system leakage is minimized.
 12. Hydronic systems are flushed, filled, and vented.
 13. Pumps are rotating correctly.
 14. Proper strainer baskets are clean and in place.
 15. Service and balance valves are open.
- B. Beginning of work means acceptance of existing HVAC conditions.

3.2 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets; Adjust total to within plus 5 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 5 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 5 percent of design.

3.3 ADJUSTING – GENERAL

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark setting of valves, dampers, and other adjustment devices allowing setting to be restored. Set and lock memory stops.
- C. After adjustment, take measurement to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- E. At the time of final inspection the TAB agency may be required to recheck, in the presence of the University's Representative, specific and random selections of data, air quantities, and air motion recorded in the certified report. Points and areas for recheck shall be selected by the

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University Representative. Measurements and test procedures shall be the same as approved for the initial work for the certified report. Selections for recheck, specific plus random, shall not exceed 10% of the total number tabulated in the report.

3.4 AIR SYSTEMS PROCEDURE (MINIMUM REQUIREMENTS)

- A. Test and adjust fan RPM to design requirements.
- B. Test and record motor full load nameplate rating and actual ampere draw.
- C. Test and record system static pressures, fan suction and discharge.
- D. Adjust all main supply and return air duct to proper design CFM.
- E. Test and adjust each diffuser, grille and register (new and existing as indicated on drawings). Reading and tests of diffusers, grilles and registers shall include design velocity (FPM) and as adjusted velocity, design CFM and adjusted CFM.
- F. Test and record outside, mixed air and discharge temperatures (D.B. for heating cycle, D.B. and W.B. for cooling cycle).
- G. In coordination with the ATC contractor, set adjustments of automatically operated dampers to operate as specified, indicated and/or noted.
- H. Test and adjust air handling and distribution systems to provide required or design supply, return, outside and exhaust air quantities.
- I. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- J. Measure air quantities at air inlets and outlets.
- K. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- L. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- M. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- N. Provide system schematic with required and actual air quantities recorded at each outlet or inlet
- O. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

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- P. Adjust outside air automatic dampers, outside air, return air and exhaust dampers for design conditions.
- Q. Measure temperature conditions across air, return air, and exhaust dampers to check leakage.
- R. Where modulating dampers are provided, take measurement and balance at extreme conditions.
- S. Measure and record pressure differentials between designated spaces.

3.5 WATER SYSTEM PROCEDURE (MINIMUM REQUIREMENTS)

- A. Prepare itemized equipment schedules, listing all heating and/or cooling elements and equipment in the systems to be balanced. List in order on equipment schedules, by pump or zone according to the design, all heating or cooling elements all zone balancing valves circuit pump and ending with the last items of equipment or transfer element in the respective zone or circuit. Include on schedule sheet column titles listing the location, type of element or apparatus, design conditions and measured conditions. Prepare individual pump report sheets for each zone or circuit.
- B. Adjust water systems (new and existing as indicated on drawings) to provide required or design quantities.
- C. Use calibrated Venturi tubes, orifices, or other metered fitting and pressure gages to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- D. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- E. Effect system balance with automatic control valves fully open to heat transfer elements.
- F. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

3.6 LABORATORY HOOD PROCEDURE

- 1. Adjust fans to deliver total indicated air flows.
- 2. Measure and adjust exhaust airflow and static pressures.
- 3. Make measurements of face velocities at multiple points, no more than 12 inches, across open sash area.
- 4. Verify that hood average face velocity complies with Contract Documents and manufacturer's recommendations.
- 5. Measure and adjust make-up airflow and static pressures for each system, where applicable.
- 6. Check the fume hood for smoke capture and containment using a smoke-emitting device.

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7. Observe smoke pattern and make adjustments to room airflow patterns to achieve optimum results.

3.7 REQUIRED REPORTS TO BE SUBMITTED

The following reports shall be submitted, as a minimum, with a complete Title Page, Summary , and Instrument List. All data and nomenclature shall be provided, as required by AABC and/or NEBB Procedure manuals, for each device tested and balanced.

1. Electric Motors.
2. VFD Drives.
3. Heating and Cooling Coils Data.
4. Air Moving Equipment.
5. Outside Air Data.
6. Duct Traverses.
7. Lab Hoods.
8. Exhaust Fans.
9. Lab supply and exhaust valves.

Existing exhaust fans R-1 thru R-7 shall be tested and balanced to the schedule shown on ME-6. New AHU 3-1 shall be tested and balanced to the schedule on ME-5. All existing fumehoods, room general exhaust and supply valves shown on ME-1 and ME-2 shall be tested and balanced to the sequence of operation shown on ME-6.

3.7 COMMISSIONING

- A. Balancing Agency shall coordinate with the Contractor the Commissioning requirements as here-in-before specified.
- B. Contractor is cautioned that the University, thru the University Representative, reserves the right to check and verify any and all points and readings of the Test and Balance report. If 15% or more of the points do not agree with the report, then the Contractor shall re-test and re-balance the entire project and submit a complete new Report. If 15% or more of this new Data is independently verified and still does not agree with the Contractor's new Report, then the Owner has the right to hire an Independent Test and Balance Contractor and the Original Contractor shall be held responsible to pay these costs.
- C. All TAB deficiencies shall be corrected when found. Any deficiencies that are (for whatever reason) not corrected immediately shall be shown in the TAB report and listed on a summary sheet in the front of the TAB report. The TAB report must be completed and accepted by the University Representative before the project is accepted and all items on the summary sheet shall become punch list items with dollar values assigned to them.

END OF SECTION 15850

SECTION 15900 – VALVES AND FITTINGS

PART 1 – GENERAL

1.1 SUMMARY

The work under this heading includes the furnishing and installing of all required appurtenances incidental to the piping systems as indicated on the drawings. Refer to GENERAL MECHANICAL REQUIREMENTS Section 15050 which shall apply to all work in this Section.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide factory-fabricated valves for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is installer's option. Valves shall be of same make for all these services.
- B. Valves shall comply with the following:
 - Gate - cast iron - MSS SP-70
 - Gate - bronze - MSS SP-80
 - Globe - cast iron -MSS SP-85
 - Globe - bronze - MSS SP-80
 - Ball - MSS SP-110
 - Butterfly - MSS SP-67
 - Check - cast iron - MSS SP-71
 - Check - bronze - MSS SP-80
- C. Gate valves shall be equipped with packing suitable for intended service. (Under no circumstances is asbestos acceptable.) Valves shall be designed so back seating protects packing and stem threads from media when valve is fully opened, and equipped with gland follower. Guides for disc on rising stem valves shall be machined for accurate fit.
- D. Globe valves shall be equipped with packing suitable for intended service. (Under no circumstances is asbestos acceptable.) Globe valves shall be designed so back seating protects packing and stem threads from media when valve is fully opened, and equipped with gland follower.
- E. Ball valves shall have FULL port opening blow out proof stem: hard chrome plated forged brass ball, rated not less than 600# W.O.G.
- F. Provide gear operators on butterfly valves 8" and larger. Valve bodies shall have extended necks to provide for 2-1/4" insulation.
- G. Provide valves with features indicated and where not otherwise indicated, provide proper valve features as outlined in this specification. Comply with ANSI B31.1.

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- H. Valve flanges shall comply to ANSI B16.1 (cast iron), ANSI B16.5(steel), ANSI B16.24 (bronze).
- I. Threaded valve ends shall comply with ANSI B2.1.
- J. Butt-Weld valve ends shall comply with ANSI B16.25.
- K. Solder Joint valve ends shall comply with ANSI B16.18.
- L. Flangeless valve bodies shall be manufactured to fit between flanges and shall comply with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).
- M. Fabricate pressure-containing components of valves, including stems and seats from brass or bronze materials, of standard alloy recognized in valve manufacturing that resist de-zincification.
- N. Design seat of valve with removable disc, and assemble valve so disc can be replaced when worn.
- O. Butterfly valves shall be designed for flow regulation, and manufactured to be tight in closed position. Test pressures in accordance with MSS SP-67 as follows: Seat 2-12" 220psi. No leakage shall be permitted under test.

2.2 BALL VALVES

- A. Threaded Ends 3" and Smaller: 600# W.O.G., forged brass two piece body, hard chrome plated forged brass ball, blow-out proof stem.
- B. Soldered Ends 2" and Smaller: 600# W.O.G., forged brass two piece body, hard chrome plated forged brass ball, true adjustable packing nut ("O"-ring only type stem seal not acceptable), blow-out proof stem..
- C. Flanged Ends 2-1/2" and larger: Class 150, flanged ends, carbon steel body with 316 s.s. trim, uni-body design, full port, blowout proof s.s. stem and ball, telfon seat.

2.3 BUTTERFLY VALVES

- A. For chilled/hot water system provide lug type with rated working pressure of 200 psi on sizes 2" thru 12". Valve shall be cast iron, drilled and tapped bug body, lever operated, 10 position throttling handle, memory plate, type 410 stainless steel stem with EPDM seat.

2.4 SWING CHECK VALVES IN STEEL PIPING

- A. Threaded Ends 2" and Smaller: Class 125, bronze body, screwed cap, "Y" pattern swing, Teflon disc.
- B. Flanged Ends 2-1/2" and Larger: Class 125, iron, bronze mounted, horizontal swing, cast-iron disc.

2.5 UNIONS IN COPPER LINES

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Cast Bronze Unions.

2.6 UNIONS IN BLACK STEEL, WROUGHT IRON OR GALVANIZED STEEL PIPING

Ground joint malleable iron galvanized Class 300 for 2" nominal pipe sizes or below. For pipe sizes 2-1/2" and larger use forged steel welding flanges (Galvanized for galvanized piping).

2.7 UNIONS IN CONNECTION BETWEEN COPPER AND STEEL OR IRON PIPING

Provide bronze valves or dielectric waterways.

2.8 STRAINERS

Through 2-1/2" Metraflex Style S - Screwed; Zurn Model YSBR 20 mesh monel screen through 2"; .045 stainless steel on 2-1/2"; Strainers on 3" and above Metraflex Style M1 - flanged; Zurn Model FS 3" to have .045 mesh, ss screws; 3-1/2" and above .125 mesh, ss screws.

2.9 GAGE COCK

Crane No. 744, or Weiss TC-14, all bronze.

2.10 AIR VENT

Automatic air vents where indicated on drawings shall be Bell & Gossett No. 7, or Taco 417, with copper discharge line piped to closet floor drain.

2.11 MANUAL AIR VENTS

Where installed shall be Crane No. 744, or Weiss TC-14, with 1/4" tap into line to be vented.

2.12 GAUGES

Furnish and install where shown on the plans or where good practice required, pressure gauges with 4-1/2 glass dial face, corrosion resistant stainless steel case and ring, balanced adjustable black pointer guaranteed accurate to 1% of range, easy read dial - white background with bold black numerals and graduations, 270 degree ARG, 1/4" N.P.T. bottom connection.

2.13 THERMOMETERS

Shall be Adjustable Angle type with 9" case, lens front reading mercury tube, with angle satin finish aluminum scales, bold black numerals, bold scale graduations, thick glass windows, and die cast aluminum case with baked bronze finish. Thermometer shall rotate 180 degrees and stem swivels 180 degrees in 10 degree increments separable wells to suit insulation. For chilled water 20 degrees to 120 degrees. For hot water 30 degrees to 240 degrees.

2.14 T.A.P. PLUGS

Furnish where shown on plans or where good practice requires 1/2" IPS plug. The Contractor shall leave with the University one kit consisting of (1) 1/8" thermometer, (1) pressure gauge and (1) gauge adaptor, 1/8" diameter with stainless steel probe, 1/4" FPT gauge connection.

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2.15 BALANCING VALVES

Valves 1/2" to 2" pipe size (NPT or Sweat) to be of dezincification brass or bronze construction. Valves 2-1/2" to 12" pipe size shall be cast iron for flanged models or ductile iron for grooved models. Valves shall be globe type rated 175 psi for iron and 240 psi for brass/bronze at 250 degrees F. Valves to have concealed memory stop feature and visual position readout. Each valve shall have two metering/test ports with internal check valves and protective caps. Valves to be leak-tight at full rated working pressure. All valves to be provided with molded insulation to permit access for balance and read-out. Nibco model T or S1710 (1/2" to 2"), F or G737 (2-1/2" to 12"), DeZurik series 12.30-1 or approved equal.

2.16 GASKETS

Material shall be of compressed sheet suitable for the operating conditions. Group 1a or 1b as listed in ASTM B16.5.

2.17 BOLTS AND NUTS

Bolts shall conform to ASTM A193/A193M Rev B, Grade B7, nuts shall conform to ASTM A194/A194M Rev A, Grade 2H.

PART 3 EXECUTION

3.1 WORKMANSHIP AND INCIDENTAL ITEMS

- A. All valves shall be installed so as to be easily accessible for cleaning, inspection, maintenance, and operation.
- B. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward for horizontal plane unless unavoidable. Provide chain operators on all valves over 6' above floor in mechanical rooms.
- C. Except as otherwise indicated, install valves with the following ends or types of pipe/tube connections:
 - Tube Size 2" and smaller - Soldered-joint valves
 - Pipe Size 2" and smaller - Threaded valves
 - Pipe Size 2-1/2" and larger - Butt-weld end valves or
Flanged end valves
- D. Install swing check valves in horizontal position, unless otherwise shown on drawings, with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow.
- E. Provide access panels at all concealed valves.
- F. Major control and sectionalizing valves throughout building shall be identified by means of a brass valve tag bracketed to valve handle. Contractor shall prepare schedule of such identifying plates and frame under glass for installation in main equipment room.
- G. All welded piping to be welded by certified welders skilled in the work to be done.

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- H. No piping of dissimilar metals placed in contact or in close proximity with each other. Provide dielectric waterways wherever piping of dissimilar metals is joined.
- I. Run all piping concealed unless specifically noted otherwise, making all necessary offsets, turns, etc., necessary to conceal piping from view.
- J. Provide all necessary steel frame supports, anchor bolts, sleeves, etc., required for safe support of equipment and piping installed under this contract. The Contractor shall be completely responsible for the accurate position and dimensions of all foundations and support items.

END OF SECTION 15900

SECTION 15950 – TEMPERATURE CONTROLS

PART 1: GENERAL

1.1 Products Not Furnished or Installed but integrated with the Work of this Section

- A. General:
 - 1. Coordination Meeting: The Installer furnishing the DDC network shall meet with the Installer(s) furnishing each of the following products to coordinate details of the interface between these products and the DDC network. The University representative shall be present at this meeting. Each Installer shall provide the University representative and all other Installers with details of the proposed interface including PICS for BACnet equipment, hardware and software identifiers for the interface points, network identifiers, wiring requirements, communication speeds, and required network accessories. The purpose of this meeting shall be to insure there are no unresolved issues regarding the integration of these products into the DDC network. Submittals for these products shall not be approved prior to the completion of this meeting.
- B. Section 15800 - Static power equipment:
 - 1. Variable frequency drives: The variable frequency drive (VFD) vendor shall furnish VFDs with an interface to the control and monitoring points specified in Section 15800. These specified points shall be the minimum acceptable interface to the VFD. The connection to these points shall be by one of the following methods: (a) Hardwired connection such as relay, 0-10VDC, or 4-20mA. (b) BACnet/IP network connection. (c) BACnet over ARCNET network connection. (d) BACnet MS/TP network connection.
- C. Communications with Third Party Equipment:
 - 1. Any additional integral control systems included with the products integrated with the work of this section shall be furnished with a BACnet interface for integration into the Direct Digital Control System described in this section.

1.2 Related Sections

- A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents.

1.3 Description

- A. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers and a web-based operator interface. Depict each mechanical system and building floor plan by a point-and-click graphic. A web server with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.
- B. The system shall directly control HVAC equipment as specified in Section 15950, Article 3.19 (Sequences of Operation). Each zone controller shall provide occupied and unoccupied modes of operation by individual zone. Furnish energy conservation features such as optimal start and stop, night setback, request-based logic, and demand level adjustment of setpoints as specified.

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- C. Provide for future system expansion to include monitoring of occupant card access, fire alarm, and lighting control systems.
- D. System shall use the native BACnet protocol for communication to the operator workstation or web server and for communication between control modules. Schedules, setpoints, trends, and alarms specified in Section 15950, Article 3.19 (Sequences of Operation) shall be BACnet objects.

1.4 Approved Control Systems

- A. The existing temperature control system is a JCI system. The existing fumehood control system is a Phoenix control system. All new work shall be compatible with existing control systems.

1.5 Quality Assurance

- A. Installer and Manufacturer Qualifications
 - 1. Installer shall have an established working relationship with Control System Manufacturer.
 - 2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

1.6 Codes and Standards

- A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:
 - 1. National Electric Code (NEC)
 - 2. International Building Code (IBC)
 - a. Section 719 Ducts and Air Transfer Openings
 - b. Section 907 Fire Alarm and Detection Systems
 - c. Section 909 Smoke Control Systems
 - d. Chapter 28 Mechanical
 - 3. International Mechanical Code (IMC)
 - 4. ANSI/ASHRAE 135-2004: Data Communication Protocol for Building Automation and Control Systems (BACNET)

1.7 System Performance

- A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).
 - 1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.
 - 2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.

3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
4. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 15 sec.
6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.
9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.
10. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2.

Table 1
Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C (±1°F)
Ducted Air	±0.5°C (±1°F)
Outside Air	±1.0°C (±2°F)
Dew Point	±1.5°C (±3°F)
Water Temperature	±0.5°C (±1°F)
Delta-T	±0.15°C (±0.25°F)
Relative Humidity	±5% RH
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see Note 2)
Electrical (A, V, W, Power Factor)	±1% of reading (see Note 3)
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO ₂)	±50 ppm

Note 1: Accuracy applies to 10% - 100% of scale

Note 2: For both absolute and differential pressure

Note 3: Not including utility-supplied meters

Table 2
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Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	± 50 Pa (± 0.2 in. w.g.) ± 3 Pa (± 0.01 in. w.g.)	0-1.5 kPa (0-6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	$\pm 10\%$ of full scale	
Space Temperature	$\pm 1.0^{\circ}\text{C}$ ($\pm 2.0^{\circ}\text{F}$)	
Duct Temperature	$\pm 1.5^{\circ}\text{C}$ ($\pm 3^{\circ}\text{F}$)	
Humidity	$\pm 5\%$ RH	
Fluid Pressure	± 10 kPa (± 1.5 psi) ± 250 Pa (± 1.0 in. w.g.)	MPa (1-150 psi) 0-12.5 kPa (0-50 in. w.g.) differential

1.8 Submittals

- A. Product Submittal Requirements: Meet requirements on Shop Drawings, Product Data, and Samples. Provide six copies of shop drawings and other submittals on hardware, software, and equipment to be installed or furnished. Begin no work until submittals have been approved for conformity with design intent. Provide drawings as AutoCAD 2006 (or newer) compatible files on magnetic or optical disk (file format: .DWG, .DXF, .VSD, or comparable) and 3 prints of each drawing on 11" x 17" paper. When manufacturer's cutsheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Provide submittals within 12 weeks of contract award on the following:

1. Direct Digital Control System Hardware

- a. Complete bill of materials indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
- b. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:
 - i. Direct digital controllers (controller panels)
 - ii. Transducers and transmitters
 - iii. Sensors (include accuracy data)
 - iv. Actuators
 - v. Valves
 - vi. Relays and switches
 - vii. Control panels
 - viii. Power supplies
 - ix. Batteries
 - x. Operator interface equipment
 - xi. Wiring
- c. Wiring diagrams and layouts for each control panel. Show termination numbers.
- d. Floor plan schematic diagrams indicating field sensor and controller locations.

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- e. Riser diagrams showing control network layout, communication protocol, and wire types.
 2. Central System Hardware and Software
 - a. Complete bill of material indicating quantity, manufacturer, model number, and relevant technical data of equipment used.
 - b. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:
 - i. Central Processing Unit (CPU) or web server
 - ii. Monitors
 - iii. Keyboards
 - iv. Power supplies
 - v. Battery backups
 - vi. Interface equipment between CPU or server and control panels
 - vii. Operating System software
 - viii. Operator interface software
 - ix. Color graphic software
 - x. Third-party software
 - c. Schematic diagrams of control, communication, and power wiring for central system installation. Show interface wiring to control system.
 - d. Network riser diagrams of wiring between central control unit and control panels.
 3. Controlled Systems
 - a. Riser diagrams showing control network layout, communication protocol, and wire types.
 - b. Schematic diagram of each controlled system. Label control points with point names. Graphically show locations of control elements.
 - c. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
 - d. Instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
 - e. Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system. List I/O points and software points specified in Section 15950, Article 3.19. Indicate alarmed and trended points.
 4. Description of process, report formats, and checklists to be used in Section 15950 Article 3.16 (Control System Demonstration and Acceptance).
 5. BACnet Protocol Implementation Conformance Statement (PICS) for each submitted type of controller and operator interface.
 - B. Schedules
 1. Schedule of work provided within one month of contract award, indicating:
 - a. Intended sequence of work items
 - b. Start date of each work item
 - c. Duration of each work item
 - d. Planned delivery dates for ordered material and equipment and expected lead times
 - e. Milestones indicating possible restraints on work by other trades or situations

2. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.
- C. Project Record Documents. Submit three copies of record (as-built) documents upon completion of installation for approval prior to final completion. Submittal shall consist of:
 1. Project Record Drawings. As-built versions of submittal shop drawings provided as AutoCAD 2006 (or newer) compatible files on magnetic or optical disk (file format: .DWG, .DXF, .VSD, or comparable) and 6 prints of each drawing on 11" x 17" paper.
 2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of Section 15950 Article 3.16 (Control System Demonstration and Acceptance).
 3. Operation and Maintenance (O&M) Manual. Printed, electronic, or online help documentation of the following:
 - a. As-built versions of submittal product data.
 - b. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
 - c. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
 - d. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
 - e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
 - f. Documentation of programs created using custom programming language including setpoints, tuning parameters, and object database. Electronic copies of programs shall meet this requirement if control logic, setpoints, tuning parameters, and objects can be viewed using furnished programming tools.
 - g. Graphic files, programs, and database on magnetic or optical media.
 - h. List of recommended spare parts with part numbers and suppliers.
 - i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
 - j. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.
 - k. Licenses, guarantees, and warranty documents for equipment and systems.
 - l. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
- D. Training Materials: Provide course outline and materials for each class at least six weeks before first class. Training shall be furnished via instructor-led sessions, computer-based training, or web-based training. Engineer will modify course outlines and materials if necessary to meet University's needs. Engineer will review and approve course outlines and materials at least three weeks before first class.

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1.9 Warranty

A. Warrant work as follows:

1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to University. Respond during normal business hours within 24 hours of University's warranty service request.
2. Work shall have a single warranty date, even if University receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
3. If Engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, Engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.
4. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve Contractor-identified software deficiencies at no charge during warranty period. If available, University can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without University's written authorization.
5. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.

1.10 Ownership of Proprietary Material

- A. Project-specific software and documentation shall become University's property. This includes, but is not limited to:
1. Graphics
 2. Record drawings
 3. Database
 4. Application programming code
 5. Documentation

PART 2: PRODUCTS

2.1 Materials

- A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by University. Spare parts shall be available for at least five years after completion of this contract.

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2.2 Communication

- A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135-2004, BACnet.
- B. Install new wiring and network devices as required to provide a complete and workable control network. Use existing Ethernet backbone for network segments marked "existing" on project drawings.
- C. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.
- D. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
 - 1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.
 - 2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified in Section 15950, Article 3.19 (Sequence of Operations). An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.
- E. Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated controller via the internetwork. If applicable, system shall automatically adjust for daylight saving and standard time.
- F. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.

2.3 Operator Interface – Existing

2.4 Controller Software – Existing

2.5 Controllers – Existing

2.6 Input and Output Interface

- A. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.
- B. Protection. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.
- C. Binary Inputs. Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.
- D. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.

- E. Analog Inputs. Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
- F. Binary Outputs. Binary outputs shall send an on-or-off signal for on and off control. Building Controller binary outputs shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.
- G. Analog Outputs. Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.
- H. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.
- I. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

2.7 Power Supplies and Line Filtering

- A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
 - 1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
 - a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
 - b. Line voltage units shall be UL recognized and CSA listed.
- B. Power Line Filtering.
 - 1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:
 - b. Dielectric strength of 1000 V minimum
 - c. Response time of 10 nanoseconds or less
 - d. Transverse mode noise attenuation of 65 dB or greater
 - e. Common mode noise attenuation of 150 dB or greater at 40-100 Hz

2.8 Auxiliary Control Devices

- A. Electric Damper and Valve Actuators.
 - 1. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.

2. Spring-return Mechanism. Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS).
 3. Signal and Range. Proportional actuators shall accept a 0-10 Vdc or a 0-20 mA control signal and shall have a 2-10 Vdc or 4-20 mA operating range. (Floating motor actuators may be substituted for proportional actuators in terminal unit applications as described in paragraph 2.6H.)
 4. Wiring. 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.
 5. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 7 N·m (60 in.-lb) torque capacity shall have a manual crank.
- B. Control Valves.
1. General. Select body and trim materials in accordance with manufacturer's recommendations for design conditions and service shown.
 2. Type. Provide two- or three-way control valves for two-position or modulating service as shown.
 3. Water Valves.
 - a. Valves providing two-position service shall be quick opening. Two-way valves shall have replaceable disc or ball.
 - b. Close-off (Differential) Pressure Rating. Valve actuator and trim shall provide the following minimum close-off pressure ratings.
 - i. Two-way: 150% of total system (pump) head.
 - ii. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
 - c. Ports. Valves providing modulating service shall have equal percentage ports.
 - d. Sizing.
 - i. Two-position service: line size.
 - ii. Two-way modulating service: select pressure drop equal to the greatest of twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 35 kPa (5 psi).
 - iii. Three-way modulating service: select pressure drop equal to the smaller of twice the pressure drop through the coil exchanger (load) or 35 kPa (5 psi).
 - e. Fail Position. Water valves shall fail normally open or closed as follows unless otherwise specified.
 - i. Water zone valves: normally open.
 - ii. Heating coils in air handlers: normally open.
 - iii. Chilled water control valves: normally closed.
 - iv. Other applications: as scheduled or as required by sequences of operation.
- C. Binary Temperature Devices.
1. Low-Voltage Space Thermostats. Low-voltage space thermostats shall be 24 V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C-30°C (55°F-85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.
 2. Line-Voltage Space Thermostats. Line-voltage space thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical

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- rating, concealed setpoint adjustment, 13°C-30°C (55°F-85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.
3. Low-Limit Thermostats. Low-limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 6 m (20 ft) long. Element shall sense temperature in each 30 cm (1 ft) section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.
- D. Temperature Sensors.
1. Type. Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
 2. Duct Sensors. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5 ft) in length per 1 m²(10 ft²) of duct cross-section.
 3. Immersion Sensors. Provide immersion sensors with a separable stainless steel well. Well pressure rating shall be consistent with system pressure it will be immersed in. Well shall withstand pipe design flow velocities.
 4. Space Sensors. Space sensors shall have setpoint adjustment, override switch, display, and communication port as shown.
 5. Differential Sensors. Provide matched sensors for differential temperature measurement.
- E. Flow Switches. Flow-proving switches shall be paddle (water service only) or differential pressure type (air or water service) as shown. Switches shall be UL listed, SPDT snap-acting, and pilot duty rated (125 VA minimum).
1. Paddle switches shall have adjustable sensitivity and NEMA 1 enclosure unless otherwise specified.
 2. Differential pressure switches shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.
- F. Relays.
1. Control Relays. Control relays shall be plug-in type, UL listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
 2. Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable $\pm 100\%$ from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.
- G. Override Timers.
1. Unless implemented in control software, override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration required by application. Provide 0-6 hour calibrated dial unless otherwise specified. Flush mount timer on local control panel face or where shown.
- H. Current Transmitters.
1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4-20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be $\pm 1\%$ full-scale at 500 ohm maximum burden.
 2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
 3. Unit shall be split-core type for clamp-on installation on existing wiring.
- I. Current Transformers.

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1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
 2. Transformers shall be available in various current ratios and shall be selected for $\pm 1\%$ accuracy at 5 A full-scale output.
 3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.
- J. Voltage Transmitters.
1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4-20 mA output with zero and span adjustment.
 2. Adjustable full-scale unit ranges shall be 100-130 Vac, 200-250 Vac, 250-330 Vac, and 400-600 Vac. Unit accuracy shall be $\pm 1\%$ full-scale at 500 ohm maximum burden.
 3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.
- K. Voltage Transformers.
1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
 2. Transformers shall be suitable for ambient temperatures of 4°C - 55°C (40°F - 130°F) and shall provide $\pm 0.5\%$ accuracy at 24 Vac and 5 VA load.
 3. Windings (except for terminals) shall be completely enclosed with metal or plastic.
- L. Power Monitors.
1. Power monitors shall be three-phase type and shall have three-phase disconnect and shorting switch assembly, UL listed voltage transformers, and UL listed split-core current transformers.
 2. Power monitors shall provide selectable output: rate pulse for kWh reading or 4-20 mA for kW reading. Power monitors shall operate with 5 A current inputs and maximum error of $\pm 2\%$ at 1.0 power factor or $\pm 2.5\%$ at 0.5 power factor.
- M. Current Switches.
1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.
- N. Pressure Transducers.
1. Transducers shall have linear output signal and field-adjustable zero and span.
 2. Continuous operating conditions of positive or negative pressure 50% greater than calibrated span shall not damage transducer sensing elements.
 3. Water pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Transducer shall have 4-20 mA output, suitable mounting provisions, and block and bleed valves.
 4. Water differential pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Over-range limit (differential pressure) and maximum static pressure shall be 2000 kPa (300 psi.) Transducer shall have 4-20 mA output, suitable mounting provisions, and 5-valve manifold.
- O. Differential Pressure Switches. Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.
- P. Pressure-Electric (PE) Switches. PE switches shall be UL listed, pilot duty rated (125 VA minimum) or motor control rated, metal or neoprene diaphragm actuated, operating pressure rated for 0-175 kPa (0-25 psig), with calibrated scale minimum setpoint range of 14-125 kPa (2-18 psig).

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1. Provide one- or two-stage switch action (SPDT, DPST, or DPDT) as required by application.
 2. Switches shall be open type (panel-mounted). Exception: Switches shall be enclosed type for remote installation. Enclosed type shall be NEMA 1 unless otherwise specified.
 3. Each pneumatic signal line to PE switches shall have permanent indicating gauge.
- Q. Local Control Panels.
1. Indoor control panels shall be fully enclosed NEMA 1 construction with hinged door key-lock latch and removable sub-panels. A common key shall open each control panel and sub-panel.
 2. Prewire internal and face-mounted device connections with color-coded stranded conductors tie-wrapped or neatly installed in plastic troughs. Field connection terminals shall be UL listed for 600 V service, individually identified per control and interlock drawings, with adequate clearance for field wiring.
 3. Each local panel shall have a control power source power switch (on-off) with overcurrent protection.

2.9 Wiring and Raceways

- A. General. Provide copper wiring, plenum cable, and raceways as specified in Section 16050.
- B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

PART 3: EXECUTION

3.1 Examination

- A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to University Representative for resolution before starting rough-in work.
- B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to University Representative for resolution before starting rough-in work.
- C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to University Representative and obtain written instructions for changes necessary to accommodate Section 15950 work with work of others. Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

3.2 Protection

- A. Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.
- B. Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

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3.3 Coordination

- A. Site.
 - 1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.
 - 2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.
- B. Submittals. See Section 15950 Article 1.10 (Submittals).
- C. Test and Balance.
 - 1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.
 - 2. Train Test and Balance Contractor to use control system interface tools.
 - 3. Provide a qualified technician to assist with testing and balancing the first 20 terminal units.
 - 4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.
- D. Coordination with Other Controls. Integrate with and coordinate controls and control devices furnished or installed by others as follows.
 - 1. Communication media and equipment shall be provided as specified in Section 15950 Article 2.2 (Communication).
 - 2. Each supplier of a controls product shall configure, program, start up, and test that product to meet the sequences of operation described in Section 15950 regardless of where within the contract documents those products are described.
 - 3. Coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
 - 4. Contractor shall be responsible for integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.

3.4 General Workmanship

- A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.
- B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.
- C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.
- D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.
- E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

3.5 Field Quality Control

- A. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 15950 Article 1.8 (Codes and Standards).
- B. Continually monitor field installation for code compliance and workmanship quality.

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- C. Contractor shall arrange for work inspection by local or state authorities having jurisdiction over the work.

3.6 Wiring

- A. Control and interlock wiring and installation shall comply with national and local electrical codes and manufacturer's recommendations.
- B. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Section 16050.
- C. Low-voltage wiring shall meet NEC Class 2 requirements. Subfuse low-voltage power circuits as required to meet Class 2 current limit.
- D. NEC Class 2 (current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.
- E. Install wiring in raceway where subject to mechanical damage and at levels below 3 m (10ft) in mechanical, electrical, or service rooms.
- F. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.
- G. Do not install wiring in raceway containing tubing.
- H. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at 3 m (10 ft) intervals.
- I. Use structural members to support or anchor plenum cables without raceway. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.
- J. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.
- K. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.
- L. Include one pull string in each raceway 2.5 cm (1 in.) or larger.
- M. Use color-coded conductors throughout.
- N. Locate control and status relays in designated enclosures only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.
- O. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 15 cm (6 in.) between raceway and high-temperature equipment such as steam pipes or flues.
- P. Adhere to requirements in Section 16050 where raceway crosses building expansion joints.
- Q. Install insulated bushings on raceway ends and enclosure openings. Seal top ends of vertical raceways.
- R. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.
- S. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Do not use flexible metal raceway less than ½ in. electrical trade size. Use liquid-tight flexible metal raceways in areas exposed to moisture including chiller and boiler rooms.
- T. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.

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3.7 Communication Wiring

- A. Communication wiring shall be low-voltage Class 2 wiring and shall comply with Article 3.7 (Wiring).
- B. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.
- C. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.
- D. Verify entire network's integrity following cable installation using appropriate tests for each cable.
- E. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.
- F. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths.
- G. Label communication wiring to indicate origination and destination.
- H. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.8 Fiber Optic Cable

- A. During installation do not exceed maximum pulling tensions specified by cable manufacturer. Post-installation residual cable tension shall be within cable manufacturer's specifications.
- B. Install cabling and associated components according to manufacturers' instructions. Do not exceed minimum cable andunjacketed fiber bend radii specified by cable manufacturer.

3.9 Installation of Sensors

- A. Install sensors according to manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for operating environment.
- C. Install room temperature sensors on concealed junction boxes properly supported by wall framing.
- D. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.
- E. Use averaging sensors in mixing plenums and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.
- F. Install mixing plenum low-limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m² (1 ft²) of coil area.
- G. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.
- H. Install outdoor air temperature sensors on north wall at designated location with sun shield.
- I. Differential Air Static Pressure.
 - 1. Supply Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.

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2. Return Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.
 3. Building Static Pressure. Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe high-pressure port to a location behind a thermostat cover.
 4. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.
 5. Pressure transducers, except those controlling VAV boxes, shall be located in control panels, not on monitored equipment or on ductwork. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.
 6. Mount gauge tees adjacent to air and water differential pressure taps. Install shut-off valves before tee for water gauges.
- J. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

3.10 Flow Switch Installation

- A. Use correct paddle for pipe diameter.
- B. Adjust flow switch according to manufacturer's instructions.

3.11 Actuators

- A. General. Mount actuators and adapters according to manufacturer's recommendations.
- B. Electric and Electronic Damper Actuators. Mount actuators directly on damper shaft or jackshaft unless shown as a linkage installation. Link actuators according to manufacturer's recommendations.
 1. For low-leakage dampers with seals, mount actuator with a minimum 5° travel available for damper seal tightening.
 2. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, then tighten linkage.
 3. Check operation of damper-actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
 4. Provide necessary mounting hardware and linkages for actuator installation.
- C. Valve Actuators. Connect actuators to valves with adapters approved by actuator manufacturer.

3.12 Warning Labels

- A. Affix permanent warning labels to equipment that can be automatically started by the control system.
 1. Labels shall use white lettering (12-point type or larger) on a red background.
 2. Warning labels shall read as follows.

CAUTION

This equipment is operating under automatic control and may start or stop at

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any time without warning. Switch disconnect to "Off" position before servicing.

- B. Affix permanent warning labels to motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.
 - 1. Labels shall use white lettering (12-point type or larger) on a red background.
 - 2. Warning labels shall read as follows.

CAUTION

This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

3.13 Identification of Hardware and Wiring

- A. Label wiring and cabling, including that within factory-fabricated panels, with control system address or termination number at each end within 5 cm (2 in.) of termination.
- B. Label pneumatic tubing at each end within 5 cm (2 in.) of termination with a descriptive identifier.
- C. Permanently label or code each point of field terminal strips to show instrument or item served.
- D. Label control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.
- E. Label each control component with a permanent label. Label plug-in components such that label remains stationary during component replacement.
- F. Label room sensors related to terminal boxes or valves with nameplates.
- G. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.
- H. Label identifiers shall match record documents.

3.14 Programming

- A. Point Naming. Name points as shown on the equipment points list provided with each sequence of operation. See Section 15950, Article 3.19 (Sequences of Operation). Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, "Zone Temp 1" for Zone 1, "Zone Temp 2" for Zone 2.
- B. Software Programming. Programming shall provide actions for each possible situation. Graphic- or parameter-based programs shall be documented. Text-based programs shall be modular, structured, and commented to clearly describe each section of the program.
 - 1. Application Programming. Provide application programming that adheres to sequences of operation, Article 3.19, specified in Section 15950. Program documentation or comment statements shall reflect language used in sequences of operation.
 - 2. System Programming. Provide system programming necessary for system operation.
- C. Operator Interface.
 - 1. Standard Graphics. Provide graphics as specified in Section 15950 Article 2.3 Paragraph E.2 (System Graphics). Show on each equipment graphic input and output points and relevant calculated points such as indicated in Section 15950, Article 3.19 (Sequences of Operation). Point information on graphics shall dynamically update.

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2. Install, initialize, start up, and troubleshoot operator interface software and functions (including operating system software, operator interface database, and third-party software installation and integration required for successful operator interface operation) as described in Section 15950.

3.15 Control System Checkout and Testing

- A. Startup Testing. Complete startup testing to verify operational control system before notifying University of system demonstration. Provide University with schedule for startup testing. University may have representative present during any or all startup testing.
 1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Section 15950.
 2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.
 3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
 4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
 5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.
 6. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.
 7. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.
 8. Alarms and Interlocks.
 - a. Check each alarm with an appropriate signal at a value that will trip the alarm.
 - b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
 - c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

3.16 Control System Demonstration and Acceptance

- A. Demonstration. Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification after and in addition to tests specified in Article 3.17 (Control System Checkout and Testing). Provide University Representative with log documenting completion of startup tests.
 1. Engineer will be present to observe and review system demonstration. Notify Engineer at least 10 days before system demonstration begins.
 2. Demonstration shall follow process submitted and approved under Section 15950 Article 1.10 (Submittals). Complete approved checklists and forms for each system as part of system demonstration.
 3. Demonstrate actual field operation of each sequence of operation as specified in Section 15950, Article 3.19. Provide at least two persons equipped with two-way

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communication. Demonstrate calibration and response of any input and output points requested by University Representative. Provide and operate test equipment required to prove proper system operation.

4. Demonstrate compliance with Section 15950 Part 1 (System Performance).
5. Demonstrate compliance with sequences of operation through each operational mode.
6. Demonstrate complete operation of operator interface.
7. Demonstrate each of the following.
 - a. DDC loop response. Supply graphical trend data output showing each DDC loop's response to a setpoint change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show setpoint, actuator position, and controlled variable values. Engineer will require further tuning of each loop that displays unreasonably under- or over-damped control.
 - b. Demand limiting. Supply trend data output showing demand-limiting algorithm action. Trend data shall document action sampled each minute over at least a 30-minute period and shall show building kW, demand-limiting setpoint, and status of setpoints and other affected equipment parameters.
 - c. Building fire alarm system interface.
 - d. Trend logs for each system. Trend data shall indicate setpoints, operating points, valve positions, and other data as specified in the points list provided with each sequence of operation in Section 15950, Article 3.19. Each log shall cover three 48-hour periods and shall have a sample frequency not less than 10 minutes or as specified on its points list. Logs shall be accessible through system's operator interface and shall be retrievable for use in other software programs as specified in Section 15950 Article 2.3 Paragraph E.11 (Trend Configuration).
8. Tests that fail to demonstrate proper system operation shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.

B. Acceptance.

1. After tests described in this specification are performed to the satisfaction of the University Representative, the University Representative will accept control system as meeting completion requirements. University Representative may exempt tests from completion requirements that cannot be performed due to circumstances beyond Contractor's control. University Representative will provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.
2. System shall not be accepted until completed demonstration forms and checklists are submitted and approved as required in Section 15950 Article 1.10 (Submittals).

3.17 Cleaning

- A. Each day clean up debris resulting from work. Remove packaging material as soon as its contents have been removed. Collect waste and place in designated location.
- B. On completion of work in each area, clean work debris and equipment. Keep areas free from dust, dirt, and debris.

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- C. On completion of work, check equipment furnished under this section for paint damage. Repair damaged factory-finished paint to match adjacent areas. Replace deformed cabinets and enclosures with new material and repaint to match adjacent areas.

3.18 Training

- A. Provide training for a designated staff of University's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.
- B. Training shall enable students to accomplish the following objectives.
 - 1. Proficiently operate system
 - 2. Understand control system architecture and configuration
 - 3. Understand DDC system components
 - 4. Understand system operation, including DDC system control and optimizing routines (algorithms)
 - 5. Operate workstation and peripherals
 - 6. Log on and off system
 - 7. Access graphics, point reports, and logs
 - 8. Adjust and change system setpoints, time schedules, and holiday schedules
 - 9. Recognize common HVAC system malfunctions by observing system graphics, trend graphs, and other system tools
 - 10. Understand system drawings and Operation and Maintenance manual
 - 11. Understand job layout and location of control components
 - 12. Access data from DDC controllers
 - 13. Operate portable operator's terminals
 - 14. Create and change system graphics
 - 15. Create, delete, and modify alarms, including configuring alarm reactions
 - 16. Create, delete, and modify point trend logs (graphs) and multi-point trend graphs
 - 17. Configure and run reports
 - 18. Add, remove, and modify system's physical points
 - 19. Create, modify, and delete application programming
 - 20. Add operator interface stations
 - 21. Add a new controller to system
 - 22. Download firmware and advanced applications programming to a controller
 - 23. Configure and calibrate I/O points
 - 24. Maintain software and prepare backups
 - 25. Interface with job-specific, third-party operator software
 - 26. Add new users and understand password security procedures
- C. Divide presentation of objectives into three sessions (1-13, 14-23, and 24-26). Participants will attend one or more of sessions, depending on knowledge level required.
 - 1. Day-to-day Operators (objectives 1-13)
 - 2. Advanced Operators (objectives 1-13 and 14-23)
 - 3. System Managers and Administrators (objectives 1-13 and 24-26)
- D. Provide course outline and materials according to Section 15950 Article 1.8 (Submittals). Provide one copy of training material per student.
- E. Instructors shall be factory-trained and experienced in presenting this material.
- F. Perform classroom training using a network of working controllers representative of installed hardware.

3.19 Sequences of Operation

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See Sheet ME-6 for existing sequences of operation for room supply and exhaust valves, and fumehood exhaust fans. Verify operation of sequences for existing hoods, fans, lab supply valves and exhaust valves for the fumehoods as indicated on the drawings. Provide a written report identifying operation of all tested components.

AHU 3-1 shall be programmed to sequence of operation shown on ME-6.

END OF SECTION 15950

SECTION 16010 – ELECTRICAL GENERAL

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, tools, materials, fixtures, equipment, accessories, transportation, etc., required for complete electrical lighting and power systems, complete with necessary auxiliaries as indicated on drawings and as hereinafter specified.
- B. The GENERAL CONDITIONS of the Contract, Drawings and Specifications shall apply to all work under this Section. Separation of Specifications into Sections is for convenience only and is not intended to establish limits of work or liability.
- C. In general, the work shall consist of the following installations:
 - 1. Power wiring and connection to new mechanical equipment.
- D. Prior to submitting quotation for electrical work, Contractor shall visit and examine the job site in order to become familiar with all existing conditions pertinent to the work to be performed thereon. No additional compensation will be allowed for failure to be so informed.
- E. It is the intent of these specifications that in all particulars, the materials and workmanship shall conform to the best practice and that the equipment and accessories as furnished and installed shall be complete and ready to operate.
- F. All materials shall be new, except where otherwise indicated, and shall conform with the standards of underwriters' Laboratories in every case where such a standard has been established for the particular type of material in question.
- G. The drawings showing the layout of electrical work indicate approximate location of the outlets, receptacles, panelboards and other electrical equipment, unless noted otherwise. The runs of feeders and branches are schematic only and are not intended to show the exact routing of conduits. Certain routings are as shown to avoid areas with asbestos materials, and may not allow for deviation. The final determination of the routing shall be governed by structural conditions, other conditions and other construction. The Contractor shall consult all drawings which may affect the location of any outlet, apparatus, or equipment to avoid possible interference and any reasonable changes in the location of an outlet, apparatus or equipment, up to the time of rough-in, is reserved by the University Representative, and any minor deviations shall be made without additional cost. It shall be the Contractor's responsibility to see that all equipment such as junction boxes, panelboards, switches, and other apparatus, as may require maintenance from time to time, are made easily accessible. Although the location of the equipment may be shown on the drawings, the construction may disclose the fact that such location does not make its position readily accessible, in which case the Contractor shall call the University Representative's attention to the condition before advancing the construction to a point where a change in location would require additional cost.

1.2 MEASUREMENTS

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Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories necessary. The Contractor shall carefully investigate structural conditions, walls, furring and chase locations and room finishes and shall make actual measurements on the job so that the panelboards, switches, receptacles, lighting fixtures and accessories shall fit.

1.3 LAWS, CODES AND PERMITS

- A. Latest edition of the following listed established standards constitute part of the specification requirements.

National Electrical Code - 2005 (NFPA No. 70)
Applicable State Requirements
Underwriters' Laboratories (UL)
Electrical Testing Laboratories (ETL)
American National Standard Institute (ANSI)
NFPA 101 Life Safety Code – 2007

1.4 JOB CONDITIONS

- A. Accompanying drawings, including plans, details, diagrams, notes, etc., are shown to limit and explain structural conditions, construction requirements, sizes, capacities and method of installation and erection. Structural and other conditions may require certain modifications and adjustments from conditions shown. Such deviations are permissible; however, specific sizes capacities and requirements affecting the satisfactory performance and operation of the installation shall remain unchanged. Make allowance for normal job conditions and interferences.
- B. Ask for details whenever uncertain about method of installation. Lack of details not requested shall not excuse improper installation and correction shall be responsibility of the Contractor.
- C. Schedule and perform all electrical work to avoid delays to the Contractor and other trades.
- D. In addition to the basic work covered under this contract, the Contractor shall plan and schedule the work to permit continuous operation of essential services of existing facilities. Planning shall also include scheduling necessary interruptions of electrical service to existing building at times when such interruptions will cause minimum interference with existing routine and services. All such interruptions shall be made only after consultation with the University. This is extremely important since included in the work is a relocation and rerouting of and connecting to existing facilities. No additional compensation will be allowed for failure to be so informed. Contractor shall provide temporary power connections as required to execute work as shown on drawings.
- E. It is essential that all adjacent areas of the building be kept in operation at all times, except when specific permission is given to contrary. Before any power or equipment is shut down for disconnecting, tie-ins, or rearranging of services, make arrangements with University representative to do this work at night, or Sunday, or at special time of day or year with length of shutdown agreed upon before work is begun. Contractor to bear any overtime or work costs in this connection.

- F. All piping, conduits, conductors and other electrical items in way of construction, shall be rerouted, relocated or otherwise adjusted to work out with such construction or changes shown or specified in any or all of various sections of specifications. Unknown electrical devices that are encountered will be referred immediately to University Representative for method of disposition before continuation of work.
- G. The Contractor shall review the drawings to become familiar with the phasing of construction required for this project.

PART 2 PRODUCTS AND INSTALLATION

2.1 APPROVALS

- A. Name of manufacturer or catalog numbers are mentioned herein in order to establish a standard as to design and quality. Other products similar in design and of equal quality may be used if submitted to the University Representative and approved by him.
- B. Within twenty-one (21) days after award of General Contract, Contractor shall submit complete dimensional shop drawings and descriptive literature covering the following equipment and materials. Written approval thereof must be obtained before ordering or installation.

Safety Switches
Wiring

Conduit and Fittings

- C. Comply with requirements regarding submittals, number of copies, and procedures.

2.2 PROTECTION OF FIXTURES, MATERIAL AND EQUIPMENT

- A. Contractor shall continuously maintain adequate protection of all his work from damage and shall protect the University's property from injury or loss, except as may be caused by agents or employees of the University. He shall adequately protect adjacent property as provided by law.
- B. Conduit openings shall be capped or plugged during installation. Fixtures and equipment shall be tightly covered and protected against dirt, moisture, chemical and mechanical injury. At the completion of the work, the fixtures, material and equipment shall be thoroughly cleaned and delivered in condition satisfactory to the University Representative.

2.3 CUTTING, PATCHING, AND SEALING

- A. All cutting and patching for the work of this Section shall be in accordance with the requirements of the GENERAL CONDITIONS. The Contractor shall perform all necessary cutting and patching required for the installation of work. Where floor or roof is cut or penetrated the structural integrity shall be maintained or restored. Cutting of structural members is prohibited except with prior approval of the University Representative.
- B. Penetrations of all walls, floors, and ceilings shall be sealed with a material capable of preventing the passage of flames and gases in accordance with the requirements of the test standard ASTM-E-814 for fire stops. The integrity of the fire rating, as indicated on the architectural drawings, shall be maintained.

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2.4 CLEANING UP

- A. This Contractor shall promptly remove from the jobsite all debris, surplus and waste materials, empty crates and cartons resulting from his work.
- B. This Contractor shall remove all oil, grease or other stains resulting from his work performed in the building or the exterior thereof.

2.5 TESTING AND BALANCING

- A. Make tests which may be required by the University or the University Representative in connection with the operation of the electrical system in the building.
- B. All tests shall be made in accordance with the latest standards of the IEEE and the NEC.
- C. The installation shall be tested for performance, grounds, and insulation resistance. "Megger" type instrument shall be used. Circuit continuity tests and operational tests on all equipment furnished and/or connected by him shall be made by the Contractor after such equipment has been installed.
- D. The tests shall be made in the presence of the University Representative. The Contractor shall notify the University or his representative. The Contractor shall notify the University and the University Representative at least seventy-two (72) hours in advance of tests. The Contractor shall provide all testing equipment and all costs shall be borne by him. Written reports shall be made of all tests. All faults shall be corrected immediately.

2.6 PAINTING

- A. Contractor shall touch-up or refinish all items of electrical equipment furnished with a factory finish coat of paint and which may have been damaged regardless of cause.
- B. All electrical equipment such as switches, panelboards, motor controllers, etc., shall be suitably identified with micarta nameplates.

2.7 GUARANTEE

Upon completion of all tests and acceptance, the Contractor shall furnish the University a written guarantee covering all electrical work under this Contract for a period of one (1) year from date of final acceptance. Upon notice from the University or University Representative during the Guarantee period, the Contractor shall replace defective materials and correct faults of workmanship and repair any damage caused thereby promptly and free of any charge. Fuses and lamps are excluded from the guarantee.

2.8 CONTRACTOR'S QUALIFICATIONS

The Contractor must be licensed to perform such work as required by State and Local laws.

2.9 DIRECTORY CARDS, NAMEPLATES AND EQUIPMENT LABELS

Provide in the directory frame of each panelboard and for each feeder switch or circuit breaker, neatly typed directory cards indicating the general area and type of electrical load.

2.10 SUBSTITUTION

- A. All specified material, equipment, fixtures, etc., entering into the work under this section of contract are subject to the prior approval or disapproval of the University Representative. Refer to Section 3.3 (Substitutions) in Instructions to Bidders for approval procedures.
- B. Materials, equipment, fixtures, etc., herein named or indicated on drawings establish the type, size, appearance and quality required of products other manufacturers must meet to be acceptable.
- C. Requests for substitutions must include necessary data to conclusively demonstrate equality in type, size, appearance, quality, etc. Any deviation in the opinion of University Representative may be cause for rejection.

PART 3 EXECUTION

3.1 COMMISSIONING

- A. Contractor shall install all items of equipment as identified in this specification in strict accordance with manufacturer's requirements (whether identified in this specification or not), shop drawings and contract documents. Contractor shall insure a complete installation. Start-up of all equipment shall be by manufacturer authorized representative. Start-up services shall be provided for as long a period of time as is necessary to insure proper operation of the equipment items. The start-up technician shall conduct all operating tests as required to insure the equipment is operating in accordance with design parameters. Complete testing of all safety and emergency control devices shall be made. The start-up technician shall submit a written report to the University Representative (prior to final punch list inspection) containing all test data recorded as required above and a letter certifying that the equipment is operating properly.
- B. Other specific items of commissioning shall be as follows:
 - 1. Test and balance all new power feeders over 50 amps in accordance with Section 16010, Article 2.5.
 - 2. Provide written reports for all tests described above prior to final punch list inspection.

END OF SECTION - 16010

SECTION 16050 – ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Applicable items of this Section shall apply to all sections of ELECTRICAL.

PART 2 PRODUCTS AND INSTALLATION

2.1 METHODS OF WIRING

- A. No wire shall be smaller than No. 12 except those for fixture drops and for control circuits of equipment. All wire shall have 600-volt insulation equivalent to type THHN/THWN unless otherwise noted on the drawings.
- B. Conductors shall be continuous from outlet to outlet and no splices shall be made except in outlet or junction boxes.
- C. Homeruns to panelboards may be collected in one or more conduits provided all circuiting is done in accordance with Code requirements and the maximum unbalanced current does not exceed the capacity of the neutral conductors.
- D. Powdered soapstone or approved pulling compound shall be used as a pulling lubricant for all non-lead covered conductors. Use Thomas and Betts Wireslick, Ideal 77 or equal.
- E. All empty conduits installed shall contain a #14 fish wire.
- F. Conduit sizes shall conform to the requirements of the National Electric Code and/or sizes shown on the drawings. Minimize size conduit shall be 1/2".
- G. Vertical penetrations of concrete slabs shall be cored and sealed with fire stop. Size and location of all sleeves are subject to the approval of the structural engineer. Conduits routed below the first floor slab shall be rigid galvanized conduit, supported using 3/8" stainless steel threaded rods and steel framing, hot-dipped galvanized after fabrication. Supports shall be spaced in accordance with NEC-346-12. Any exposed conduits on exterior of building, shall be heavy wall hot dipped galvanized rigid conduit.
- H. Conduits in metal stud walls, exposed within mechanical and electrical rooms, and above ceilings shall be EMT. Conduits in hollow cmu walls shall be EMT with concrete tight set screw fittings. Conduits in solid, infilled cmu walls shall be Schedule 40 PVC.
- I. All raceways shall be concealed unless otherwise indicated.
- J. All conduit and tubing shall be Armco, Plastic Wire & Cable, Steelduct, Republic, Allied, or approved equal.
- K. Branch circuit conduits feeding outlets in masonry walls shall be concealed in masonry. Where outlet boxes are indicated in bare masonry walls, the box shall be mounted so that two edges of the box or plaster cover will fall in a mortar joint. Where switchboxes will not accommodate the number of conductors required and 4" square or larger boxes are installed,

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- the device covers shall be manufactured by Steel City Manufacturing Co., or Appleton, 1" minimum in depth, with straight rectangular openings for drywall construction. Where grouting is required to fill up improperly cut openings in the masonry, the work will be rejected. Contractor shall cooperate with the bricklayer to insure a neat and workmanlike job.
- L. Solderless Fixed spring connectors (T & B 10-100, Ideal wrap-cap, or equal) shall be used for all branch circuit wiring and fixture connections on all conductors #10 AWG and smaller. Split bolt or 2 bolt connectors (T & B 6 HPW, O-Z Gedney PMX, or equal) shall be used for connections and splices on all conductors #8 AWG or larger.
 - M. Connections to all motors not equipped with a portable cord shall be made with a short piece of flexible metal conduit between rigid conduit system and motor terminal box. Ground bond of separate copper conductor shall be made between motor frame and rigid conduit system. In all outdoor locations, liquid tight flexible metal conduit shall be used.
 - N. All recessed fixtures, unless they contain a box approved for THW wire shall be wired with THHN, in three feet (3') maximum of flexible metal conduit from a box at least one foot (1') from the fixture. Not more than two individual or two rows of continuous fixtures shall be connected to any one of these outlet boxes. This box shall be located above the ceiling and shall be accessible by removing fixture. Installation of blank covers on ceilings to provide access to such boxes will not be acceptable.
 - O. Splices in all low voltage wiring shall be made at terminal blocks furnished with the equipment. At junction boxes or where other splices are required, these splices shall be soldered.
 - P. Other routings than those indicated may not be used without the approval of the University Representative, but Contractor shall make allowance for possible obstructions to routes indicated. Conduits shall be grouped together and run on common hangers parallel to building lines in areas of open ceilings.

2.2 WIRING IN RACEWAYS

- A. Conduit sizes shall conform to requirements of the National Electrical Code and/or sizes shown on drawings.
- B. It is not mandatory that all conduits be routed as shown on the drawings. Other routings facilitating speed and ease of installation may be used, provided the general intent of these specifications is followed and the specific intent of the particular circuit or circuits and the National Electrical Code are not violated; such changes and must be approved by the Engineer before work is done. Contractor shall make full allowances for possible obstructions to these routes, as no extra charges will be allowed for added lengths that may be necessary.
- C. Conduits shall be installed in a neat appearing manner and shall be rigidly secured in place. The use of wooden plugs in masonry or concrete as a base to fasten raceways will not be permitted. Approved anchors only shall be used for this purpose. Exposed conduits shall be installed with runs arranged parallel or perpendicular to walls and ceilings, with rigid angle turns consisting of symmetrical bends, condulets and junction boxes. Bends and offsets shall be held to a minimum. Conduits shall be kept at least six (6") inches from parallel runs of hot piping flues, or other hot objects.

ELECTRICAL MATERIALS AND METHODS

- D. Conduits shall be cut with a hacksaw; ends must be square, threads cut and cleaned before reaming. Conduits must be securely fastened to all outlet and junction boxes with two locknuts and one bushing of approved make, care being exercised to see that full number of threads project through to permit bushings to butt up tight against the end of the conduit, after which the locknuts shall be screwed tight. Conduit shall be joined by approved conduit couplings and shall have ends butted in all cases where couplings are used. Use three piece threaded electrical unions where standard couplings cannot be used. The use of running threads will not be permitted. Where condulets cannot be joined by standard thread couplings, approved type conduit unions shall be used. Connectors and couplings for electric metallic tubing shall be of the set screw type. Couplings for rigid heavy-wall conduit shall be of the threaded type.
- E. Conduit fittings shall be Crouse-Hinds or Appleton grounding type, or approved equal.
- F. Insulated bushings shall be provided for all conductors #4 and larger.
- G. No wire shall be pulled in until the conduit system is complete and plastering dried. This does not include the white finish coat of plaster.
- H. During Construction, all outlet boxes and conduit stub-ins shall be suitably protected against the entrance of foreign material.

2.3 BOXES AND FITTINGS

- A. Boxes and fittings shall conform to requirements of Article 370 of the N.E.C.
- B. Junction and pull boxes required by field conditions shall be installed whether indicated on drawings or not.
- C. The location of outlets not specifically dimensioned on the drawings should be considered as approximate only. The Contractor shall study the general plans with relation to the spaces surrounding each outlet in order that his work fit the work of others so that when fixtures or other fittings are installed, they will be symmetrically located according to design requirements.
- D. Use only galvanized outlet and junction boxes, conduit fittings, covers, and supports for interior wiring and cast fittings and boxes with gasketed covers for exterior wiring. The Contractor shall provide all necessary structural supports for boxes and cabinets. Kindorf or Unistrut channels shall be used where applicable.
- E. Boxes for concealed outlets shall be 4" square by 1-1/2" deep, or larger, with raised device covers as required, except that 2-3/4" deep switch boxes may be used where only one conduit enters a box.
- F. Boxes for concealed ceiling outlets shall be 4" octagonal by 1-1/2" deep, or larger. Boxes in plaster ceilings shall have plaster covers. Fixture outlet boxes shall be equipped with fixture studs secured to the boxes.

- G. Outlet boxes for exposed work shall be 4" square by 1-1/2" deep, or larger. Boxes shall have Appleton 1/2" deep surface metal covers to accommodate the devices indicated, or approved equal.
- H. In walls or ceilings of concrete, tile or other non-combustible material, boxes and fittings shall be so installed that the front edge of the box or fitting will not set back of the finished surface more than 1/4". In walls or ceilings constructed of wood or other combustible material, outlet boxes and fittings shall be set flush with the finished surface.
- I. If a fixture, canopy or pan is used as an outlet box cover, any combustible wall or ceiling finish between the edge of the canopy and the outlet box shall be covered with non-combustible material.
- J. Fixture studs shall be installed in all fixture outlets. In each case, the maximum permissible number of conductors shall be reduced by one.
- K. Appropriate galvanized blank covers, subject to approval of the Engineer, shall be installed over outlet or junction boxes which do not house a device. Multiple devices shall be installed in one-piece multi-gang box with one-piece multi-gang cover plates. On surface mounted switch and receptacle outlets, provide raised covers to permit mounting devices without additional device plates.
- L. For junction and pull boxes, 14 gauge or thicker sheetmetal. Attach covers by means of 1/4" X 20 round head machine screws. In damp locations, provide rubber or neoprene gaskets.
- M. Attention is called to National Electrical Code, Article 370, Paragraph 370-16, Sub-paragraph (a) and (b) relative to allowable number of conductors in outlet boxes. Contractor shall make provisions to prevent overcrowding outlet and junction boxes regardless of number of conductors shown on the drawings at the outlets. There shall be no deviations from Code requirements on this subject.

2.4 CONDUCTORS

- A. All conductors shall be copper and no wire shall be less than #12 AWG except as otherwise noted herein and or indicated on drawings.
- B. All conductors, except as herein noted and/or as indicated on drawings, shall have 600 volt insulation type THHN/THWN. Wiring through channels of continuous surface or suspended fluorescent fixtures shall be Type RHH, or THHN.
- C. Recessed fluorescent fixtures shall be fed with type THHN, or RHH conductors and recessed incandescent fixtures shall be fed with Type THHN conductors.
- D. Conductors #8 and larger shall be stranded. Feeders shall be of the size and type indicated on drawings.
- E. Type MC cable shall not be used.

2.5 GROUNDING

- A. Grounding shall conform to the requirements of Article 250 of the N.E.C.

ELECTRICAL MATERIALS AND METHODS

July 16, 2021

16050 - 4

- B. Contractor shall provide grounding as indicated on drawings, or as required by the modifications to the distribution system.
- C. A grounding conductor shall be provided in all conduit. The grounding conductor shall be green insulated, with a minimum size of #12 AWG, or as indicated on the drawings or per NEC-250. Grounding conductors routed entirely in soil as part of the ground loop shall be bare copper. The grounding conductor connecting the electrical service to the ground system shall be green insulated copper.
- D. Bond jumpers shall be used around concentric or eccentric knockouts on service equipment.
- E. Grounding pole of each polarized receptacle shall be bonded to its outlet box with copper wire and machine or self-tapping screw.

2.6 EQUIPMENT SUPPORTS

All electrical switches, panels, appurtenances, etc., shall be rigidly supported on Unistrut or equal steel framing which shall be securely fastened to walls, floors, ceilings, etc., as required. Details of framing must be submitted to Engineer for approval before installation.

2.7 MOUNTING HEIGHTS

- A. If not otherwise indicated in the drawings, mounting heights to centerline of outlets shall be as follows:
- B. Receptacles - 18" above finished floor except above counter where indicated, or as directed by Owner.
- C. Light Switches - 48" above finished floor.
- D. Panelboard - Not more than 6'-0" from topmost operating handle to floor.
- E. Bracket Fixtures - 8'-0" above floor, or where mounted above exterior door, mirror, medicine cabinet, at a height just sufficient to clear the swing of the door or medicine cabinet.
- F. The above mounting heights may be adjusted as required to permit bottom or top of plate to align with mortar joints in unfinished masonry walls, provided joints are not raked. Where joints are raked, adjust height as required to insure that center of outlet box will be in center of a masonry unit.

2.8 SAFETY SWITCHES

- A. Safety switches shall be of the visible blade, heavy duty knife switch type. They shall be of the fused or unfused type as required. Fused switches shall have positive pressure fuse clips. Switches shall be fully interlocked with provision to neutralize the interlock by a screwdriver while under load without interrupting the circuit. Switches shall be complete with insulated base and pressure or solderless lugs. All switches shall be horsepower rated, capable of breaking stalled-rotor motor current at these ratings. Outdoor locations shall have NEMA Type 3R enclosures, indoor locations shall have NEMA 1 enclosures.

ELECTRICAL MATERIALS AND METHODS

- B. Switches shall have provision for padlocking in the "ON" or "OFF" positions. Safety switches, as indicated on plans, shall be Siemens, General Electric, Cutler-Hammer, or Square D.

2.9 FUSES

- A. Fuses utilized shall provide type 2 "no damage" as defined by IEC 947. All fuses shall have a minimum interrupting rating of 200,000 A. Fuses protecting transformers shall be Class J or RK5 time delay. Fuses protecting motor loads shall be Class J or RK1 current limiting. Provide one set of spare fuses for each load protected. Fuses shall be manufactured by Ferraz-Shawmut, Cooper Bussman, or approved equal.

2.10 TERMINATIONS

All termination lugs shall be rated 75 degrees C or higher, and shall be compatible with number and size of wires to be terminated.

END OF SECTION - 16050

SECTION 16900 - ELECTRICAL EQUIPMENT CONNECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Applicable items of all other ELECTRICAL SECTIONS shall apply to this Section.
- B. All Drawings and General Provisions of the Contract, including General Conditions, Supplementary Conditions apply to this Section.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

3.1 MECHANICAL EQUIPMENT

- A. All power wiring associated with the MECHANICAL SECTION of these Specifications shall be done by this Contractor.
- B. Contractor will furnish and set all motors.
- C. Overload elements in all starters shall be selected according to actual motor nameplate full load current. Responsibility for this coordination shall lie with the Contractor who has furnished the particular starter.
- D. All manual starting switches shall be furnished and installed by the Contractor.
- E. All disconnect switches shall be furnished and installed as indicated and as required by the Contractor.
- F. Refer to MECHANICAL SECTION and to MECHANICAL PLANS for any additional electrical work required.

END OF SECTION - 16900

DRAWINGS

UNIVERSITY of NEW ORLEANS

CHEMICAL SCIENCE ANNEX

THE UNIVERSITY of NEW ORLEANS
Lakefront Campus

Legend:

- 1. Honer L. Hitt Alumni Ctr.
- 2. Information
- 3. Kinoshita Hall
- 4. Lafitte Village
- 5. Liberal Arts Bldg.
- 6. Mathematics Bldg.
- 7. Milneburg Hall
- 8. Norman Ctr.
- 9. Oliver S. Pa Ctr (TRAC)
- 10. Performing Arts Ctr.
- 11. Computer Center
- 12. Pontchartrain Hall North
- 13. Pontchartrain Hall South
- 14. Provost's Office
- 15. The Cove
- 16. University Ctr.
- 17. Recreation & Fitness Ctr.
- 18. Science Bldg.
- 19. Research & Technology Park
- 20. Advanced Technology Ctr.
- 21. Ctr. for Energy Research & Management
- 22. Navy Jeds Tech Ctr.

East Campus

Map Labels: Lake Pontchartrain, Lakeshore Drive, Levee Road, Harwood Drive, Founders Road, Milneburg Road, Alumni Drive, Elyse Fields Ave., Leon C. Simon Blvd., Press Dr.

1. CONSTRUCTION NOTES:
2. SHUTDOWNS MUST BE SCHEDULED WITH UNIVERSITY REPRESENTATIVE A MINIMUM OF ONE WEEK BEFORE PERFORMING WORK.
3. CONTRACTOR SHALL VISIT SITE AND INCLUDE ALL OFFSETS REQUIRED FOR CONDITIONS SHOWN ON DRAWINGS.
4. ALL SURPLUS MATERIAL SHALL BE HAULED OFF SITE AND LEGALLY DISPOSED OF.
5. THE CONTRACTOR SHALL HAVE 180 CALENDAR DAYS TO COMPLETE THE WORK.
6. ALL ELECTRICAL WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE.
7. COORDINATE ALL CONTROL WORK WITH EXISTING JCI METASYS CONTROL SYSTEM.

TABLE OF CONTENTS:	
T1	TITLE SHEET
ME1	2ND FLOOR PLAN - MECHANICAL & ELECTRICAL
ME2	3RD FLOOR PLAN - MECHANICAL & ELECTRICAL
ME3	ROOF PLAN - MECHANICAL & ELECTRICAL
ME4	LARGE SCALE MECHANICAL ROOM - MECHANICAL & ELECTRICAL
ME5	SCHEDULES & DETAILS
ME6	SCHEDULES & DETAILS



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Chemical science annex
outside air unit replacement

University of New Orleans

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values stated herein are valid on the original drawings only. Contractor shall carefully review all dimensions and conditions shown and report to the engineer any errors, inconsistencies, or omissions discovered.

These plans were prepared in this office under our personal supervision, and to the best of our knowledge comply with state and local codes. We will generally administer construction.

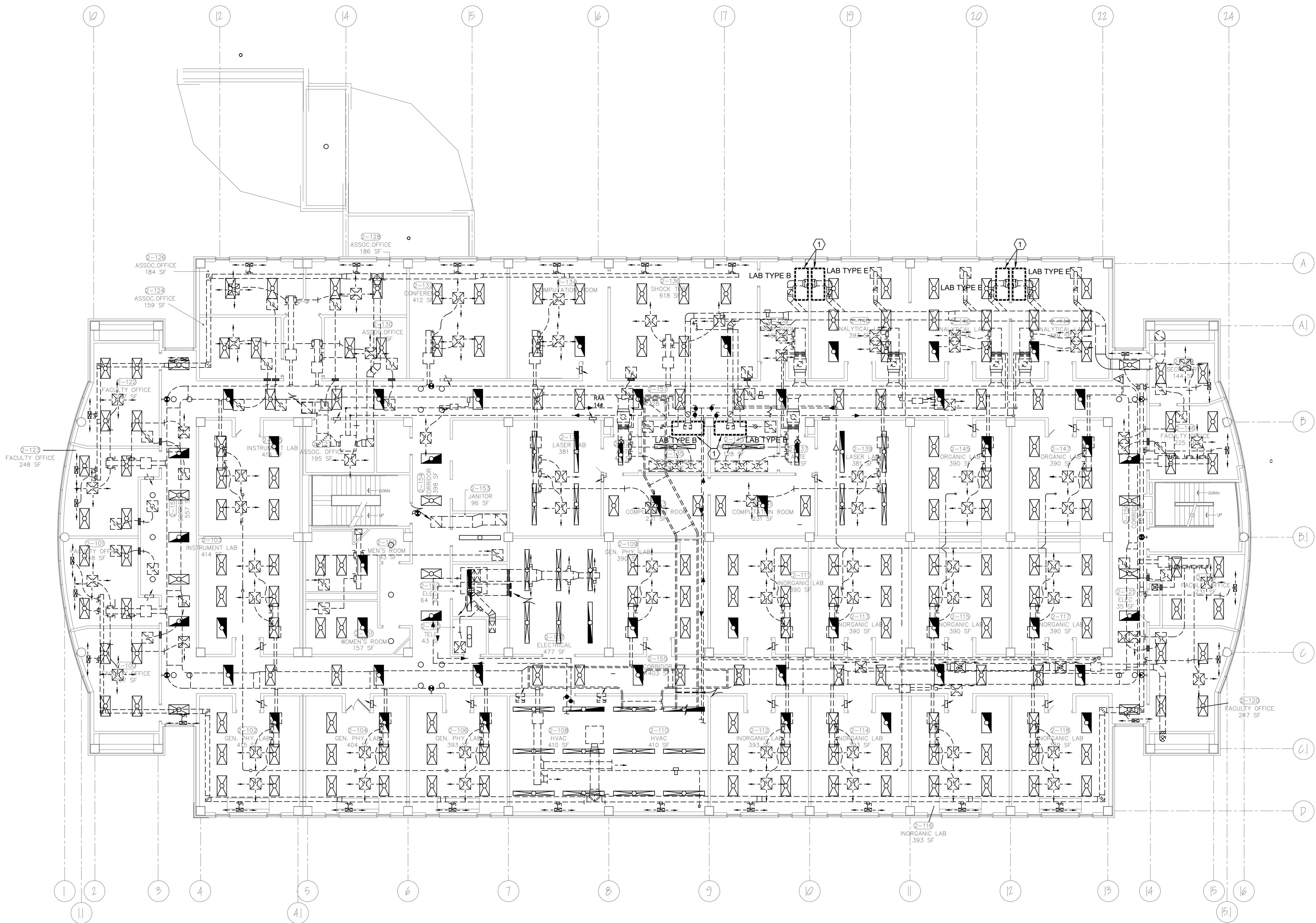
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JUL. 2021

sheet

1



- GENERAL NOTES THIS SHEET:
- EXISTING HVAC SHOWN DASHED.
 - SEE SECTIONS 15850 AND 15950 FOR TEST AND BALANCE AND CONTROL VERIFICATION FOR EXISTING FUMEHOODS, GENERAL EXHAUST AND SUPPLY VALVES IN EACH LAB TYPE SHOWN ON THIS SHEET.
- SPECIFIC NOTES THIS SHEET:
- ① EXISTING FUME HOOD. TEST HOOD CONTROLS AND AIRFLOW. SEE ME6 FOR MORE INFORMATION.

1 2ND FLOOR PLAN - MECHANICAL & ELECTRICAL
ME1 | ME1
3/32"=1'-0"



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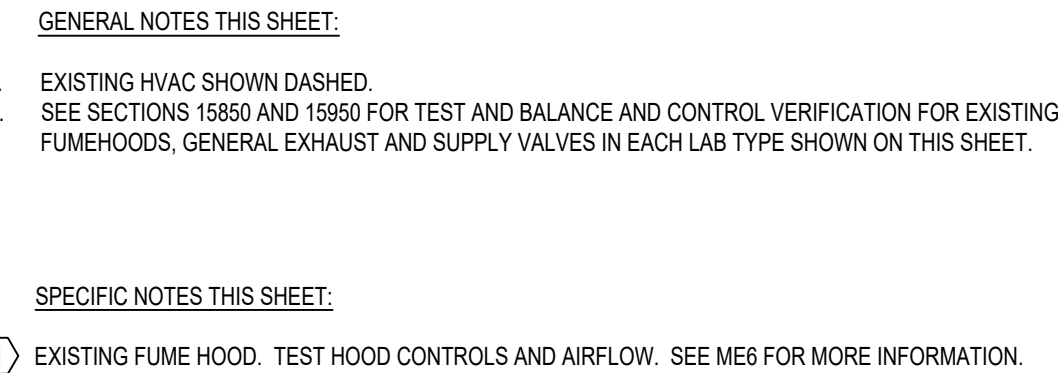
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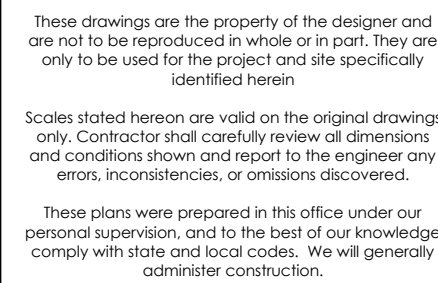
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PROJ. #.	revisions	
	date	sheet
	16 JUL. 2021	

ME1

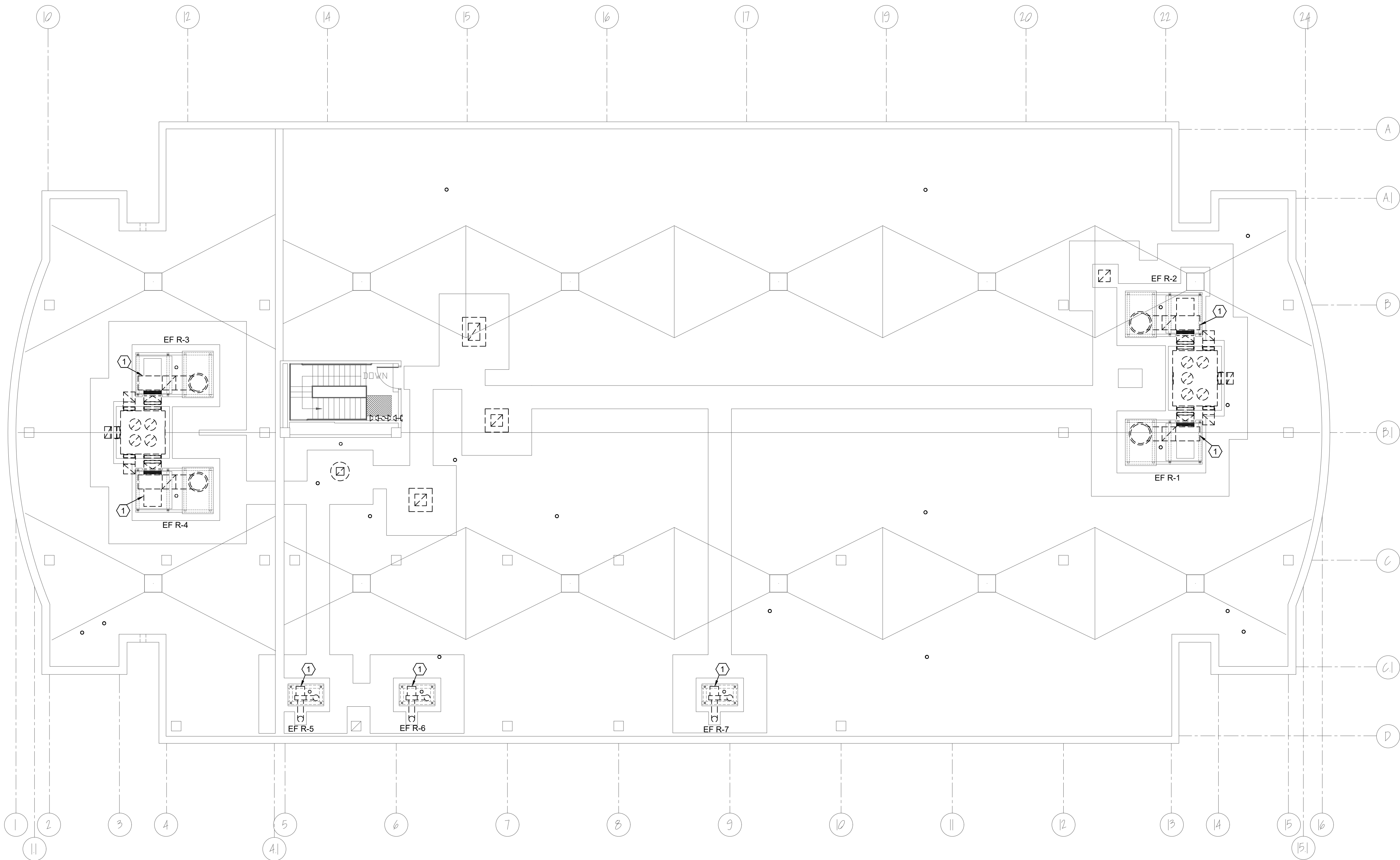


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New Orleans, Louisiana 70148



ME2

1 3RD FLOOR PLAN - MECHANICAL & ELECTRICAL
ME2 ME2 3/32"=1'-0"



GENERAL NOTES THIS SHEET:

1. EXISTING HVAC SHOWN DASHED.

SPECIFIC NOTES THIS SHEET:

- ① EXISTING FUME HOOD EXHAUST FAN. TEST FAN CONTROLS AND AIRFLOW. SEE ME6 FOR MORE INFORMATION.

1 2ND FLOOR PLAN - MECHANICAL & ELECTRICAL
ME3 | ME3 3/32"=1'-0"



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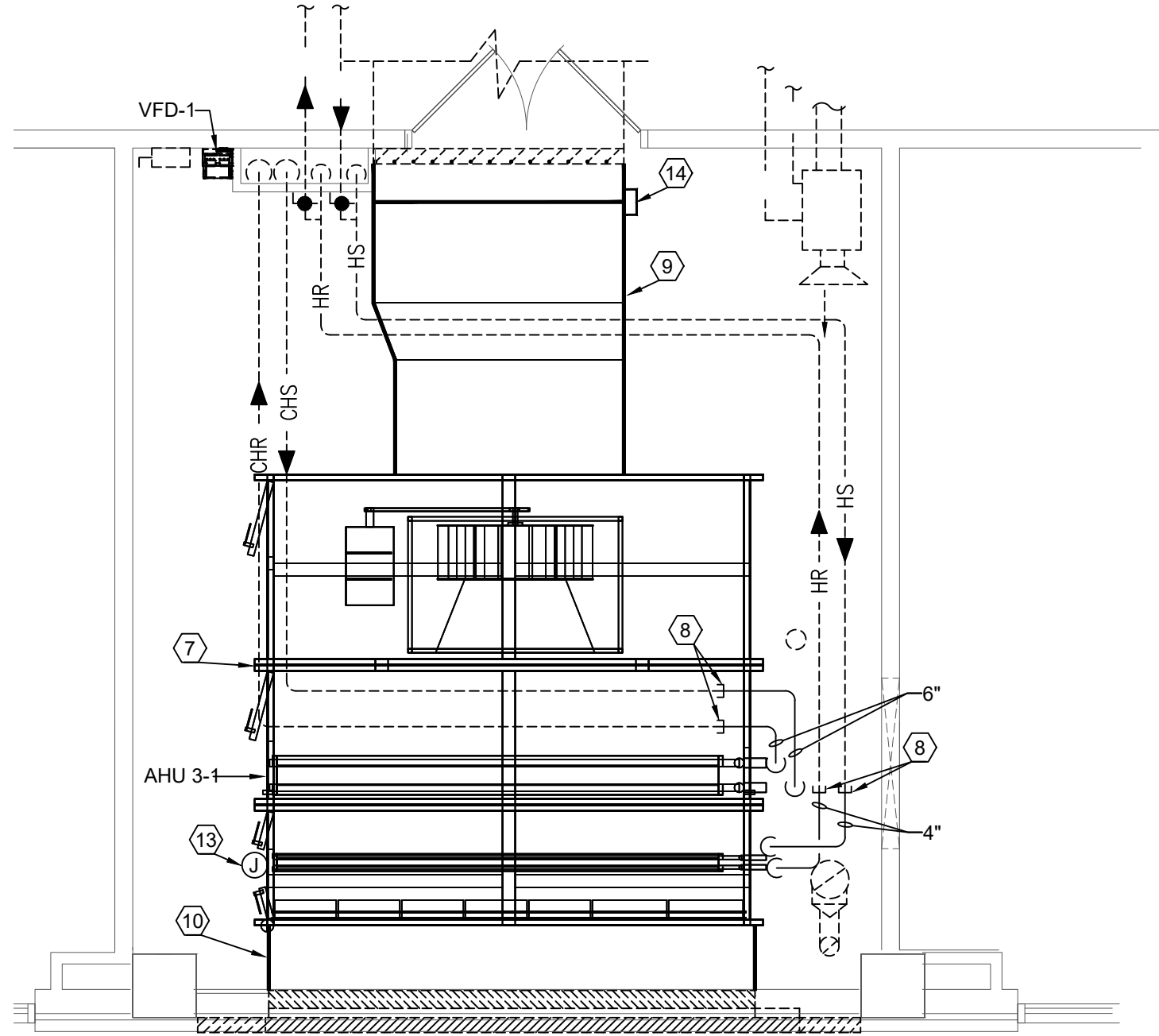
PROJ. #.	revisions	
	date	description

date

16 JUL. 2021

sheet

ME3



NOTES:

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE NEC.
2. VERIFY EXACT ROUTING OF ALL CONDUIT IN THE FIELD.
3. SCHEDULE POWER SHUTDOWNS WITH THE OWNER.

- SPECIFIC NOTES THIS SHEET:
- ① REMOVE EXISTING AIR UNIT AND SUPPORT BASE. EQUIPMENT PAD TO REMAIN.
 - ② REMOVE PIPING AS REQUIRED FOR AIR UNIT DEMOLITION. CAP FOR RECONNECTION TO NEW AIR UNIT.
 - ③ EXISTING DUCT DETECTOR SHALL BE REUSED.
 - ④ REMOVE OUTSIDE AIR SUPPLY DUCT.
 - ⑤ EXISTING FIRE DAMPER TO REMAIN.
 - ⑥ REMOVE AND REINSTALL LOUVER AS REQUIRED FOR AIR UNIT REMOVAL AND REINSTALLATION.
 - ⑦ NEW 100% OUTSIDE AIR UNIT.
 - ⑧ CONNECT TO EXISTING PIPING. RUN PIPING TO NEW COIL. SEE COIL PIPING DETAIL ON ME5.
 - ⑨ NEW OUTSIDE AIR SUPPLY DUCT. CONNECT TO NEW FAN DISCHARGE AND EXISTING OUTSIDE AIR DUCT CAPPED AT CORRIDOR WALL. VERIFY EXACT SIZE ON SITE.
 - ⑩ TRANSITION AND CONNECT UNIT RETURN OPENING TO EXISTING LOUVER. VERIFY EXACT SIZE ON SITE.
 - ⑪ EXISTING 100A, 3P D.S. TO REMAIN.
 - ⑫ REMOVE EXISTING VFD AND PROVIDE NEW VFD-1.
 - ⑬ JUNCTION BOX FOR UV LIGHTS AND AHU 120V POWER. HOMERUN TO NEAREST 120V, 20A 1P BREAKER.
 - ⑭ INSTALL EXISTING DUCT DETECTOR AND PROVIDE NEW SAMPLING TUBE. RECONNECT TO EXISTING FIRE ALARM WIRING.

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ME4

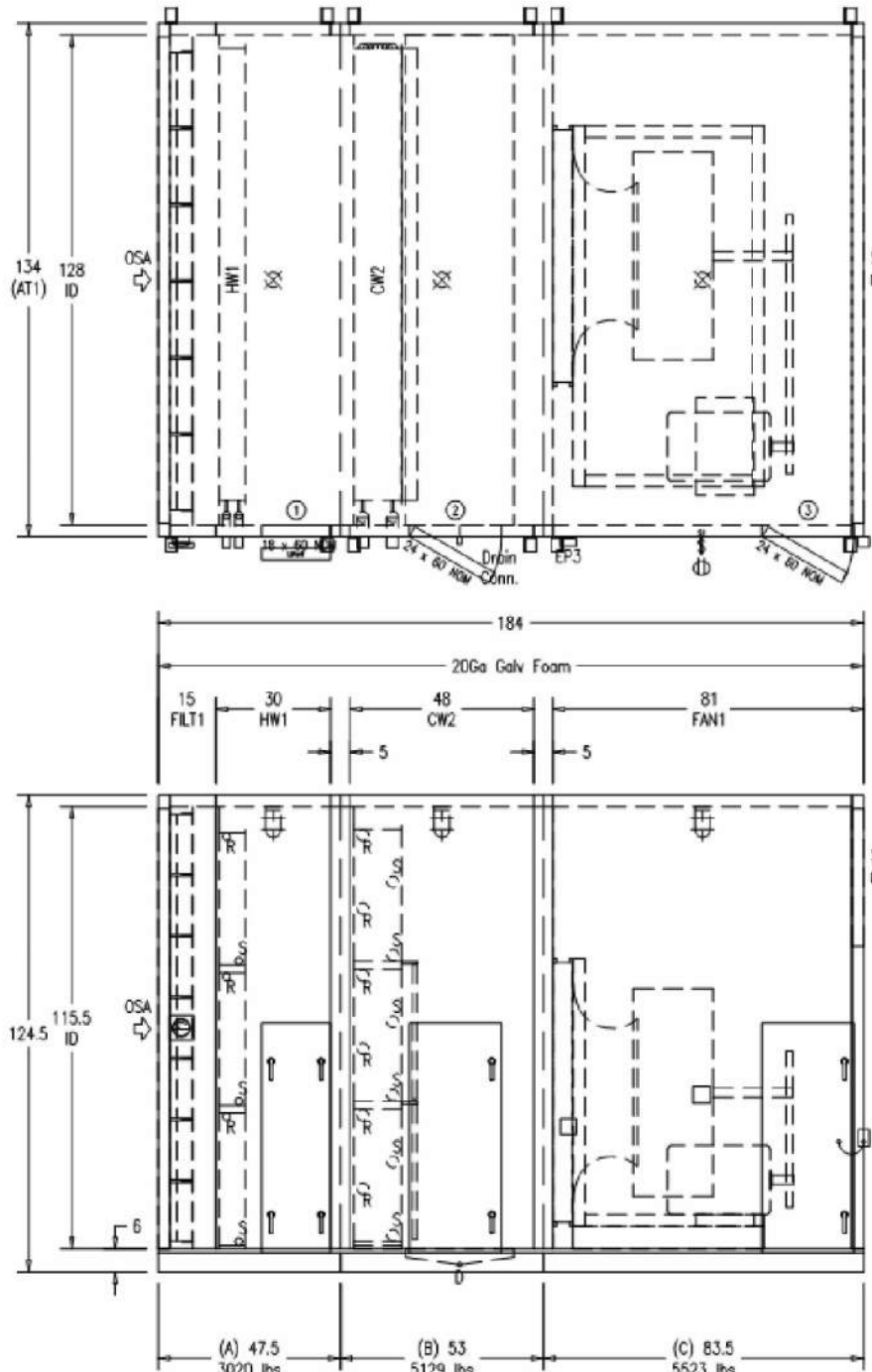
MECHANICAL			LEGEND	
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	
— CHHS —	CHILLED-HOT WATER SUPPLY	F.D.	FLOOR DRAIN	
— CHHR —	CHILLED-HOT WATER RETURN	(TYP)	TYPICAL	
— CWS —	CHILLED WATER SUPPLY	CONN.	CONNECTION	
— CWR —	CHILLED WATER RETURN		GATE VALVE	
— HWS —	HEATING WATER SUPPLY		CHECK VALVE	
— HWR —	HEATING WATER RETURN		VALVE IN VERTICAL RISE	
— G —	GAS PIPING		UNION	
DN	DOWN		FLOOR DRAIN	
	BALL VALVE		PIPING TEE	
	CONTROL TEMP. SENSOR		CONTROL FLOW METER	
	PRESSURE GAUGE	--- V ---	VENT PIPING	
	BALANCING VALVE	— UGV —	UNDER GROUND VENT PIPING	
	THERMOMETER		ASME T & P RELIEF	
	TEMPERATURE SENSOR		HUMIDITY SENSOR	
	CO2 SENSOR		VOLUME DAMPER	

VARIABLE		FREQUENCY			DRIVE		SCHEDULE
MARK	SERVICE	HP	VOLT	PH	TYPE	DESCRIPTION	
VFD-1	AHU 3-1	60	460	3	NEMA 1	PWM VARIABLE FREQ. DRIVE WITH CIRCUIT BREAKER, MANUAL BYPASS	

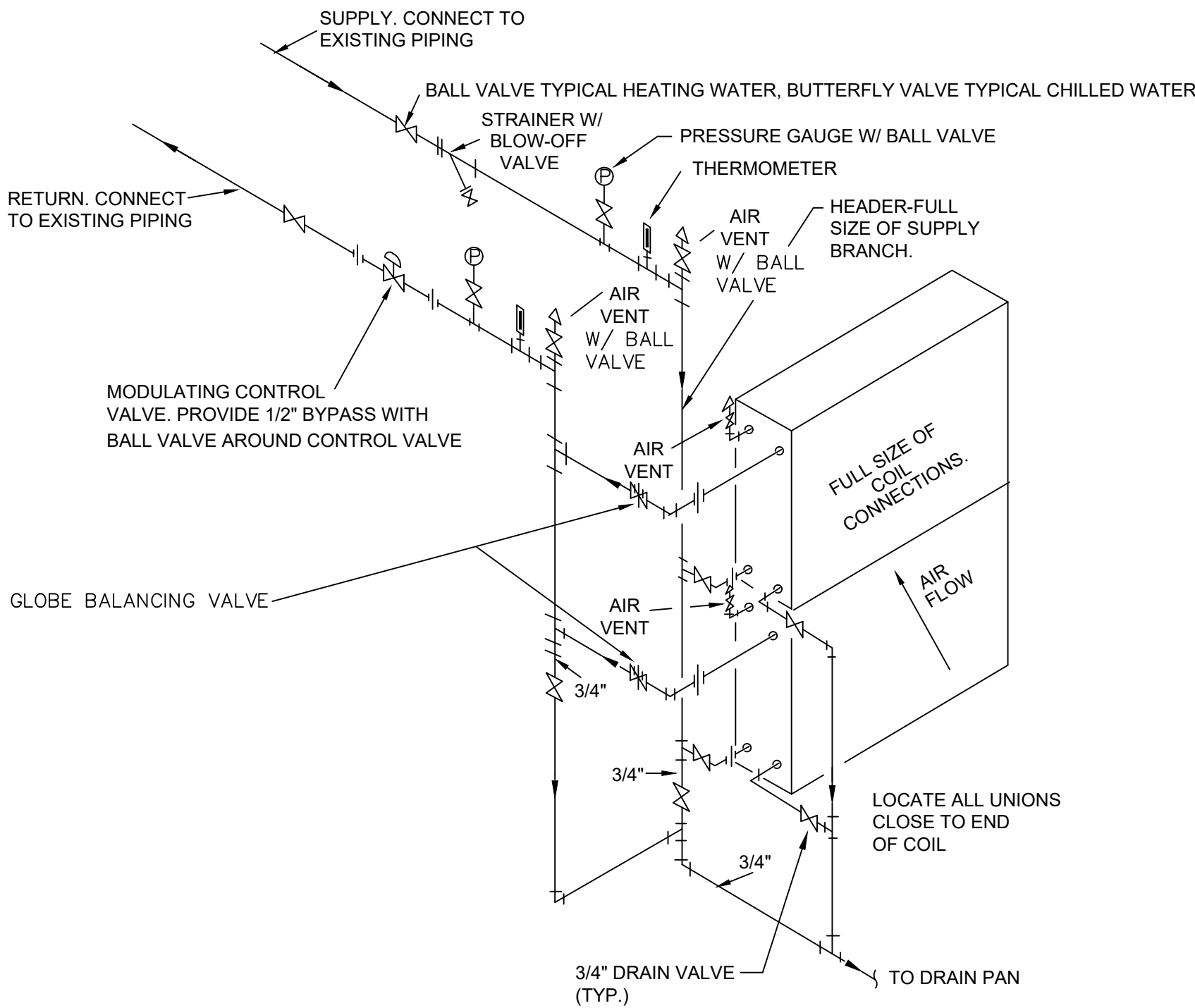
ELECTRICAL		LEGEND
SYMBOL	DESCRIPTION	
	DISCONNECT SWITCH W/VISIBLE BLADES	
	STARTER/ DISCONNECT	
	JUNCTION BOX	
	ELECT. MOTOR W/APPROVED DISC. SWITCH	
—	CONDUIT / WIRING	
	SPEAKER STROBE TO MATCH EXISTING DEVICES	
\$ ³	3-WAY LIGHT SWITCH	
\$ ₀	OCCUPANCY SENSOR LIGHT SWITCH	

CONTROL VALVE SCHEDULE				
MARK	SERVICE	GPM	VALVE SIZE (IN)	PIPE SIZE (IN)
CV-1	AHU 3-1 COOLING	541	4"	6"
CV-2	AHU 3-2 HEATING	122	2.5"	4"

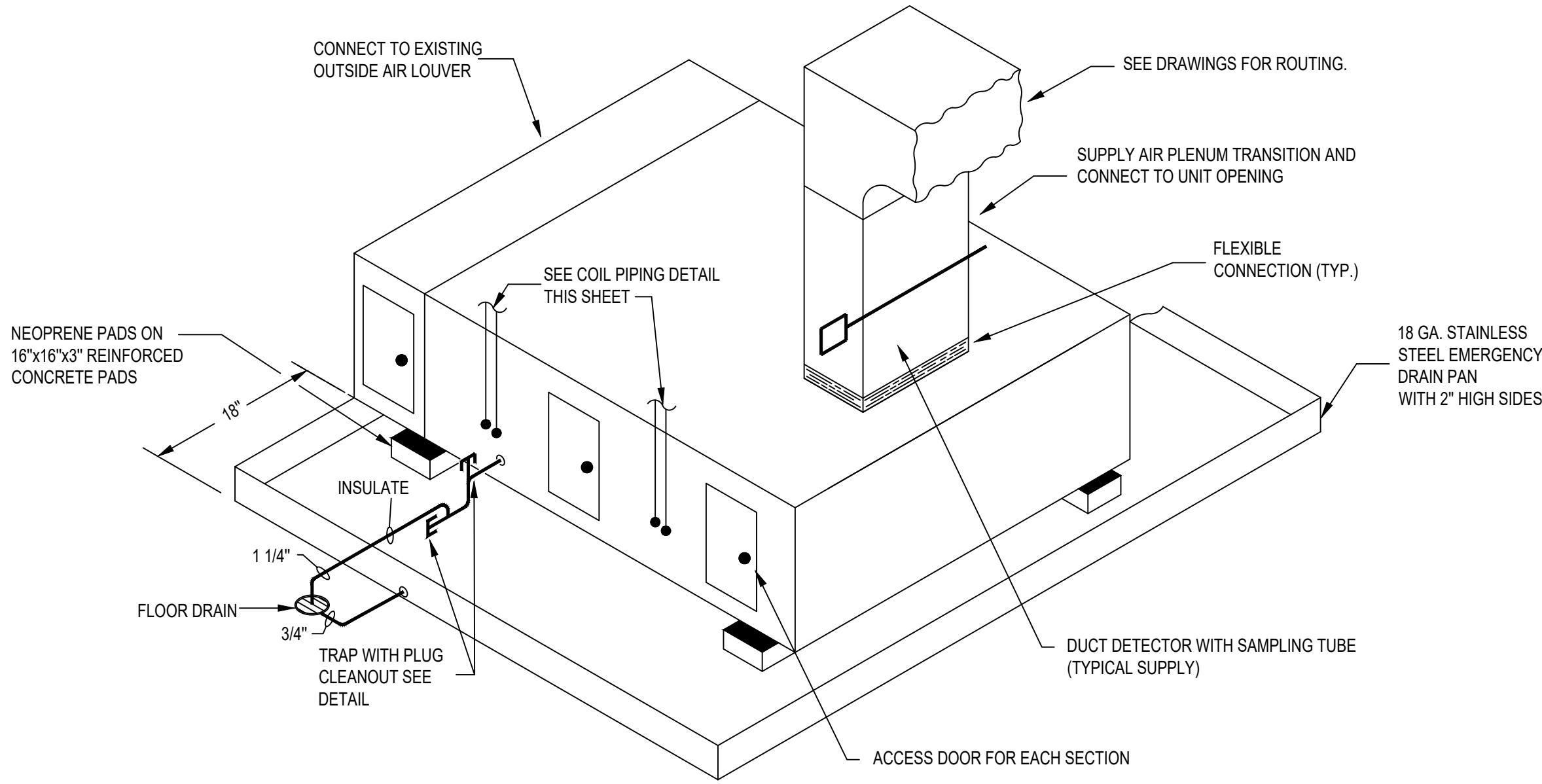
NOTES:
1. ALL VALVES TO HAVE DDC BACNET ACTUATORS.
2. ALL VALVES TO BE 2-WAY.
3. PROVIDE REDUCERS AS REQUIRED.
4. ALL VALVES TO BE NORMALLY CLOSED UNLESS INDICATED OTHERWISE.



AHU 3-1 LAYOUT DETAIL
NO SCALE



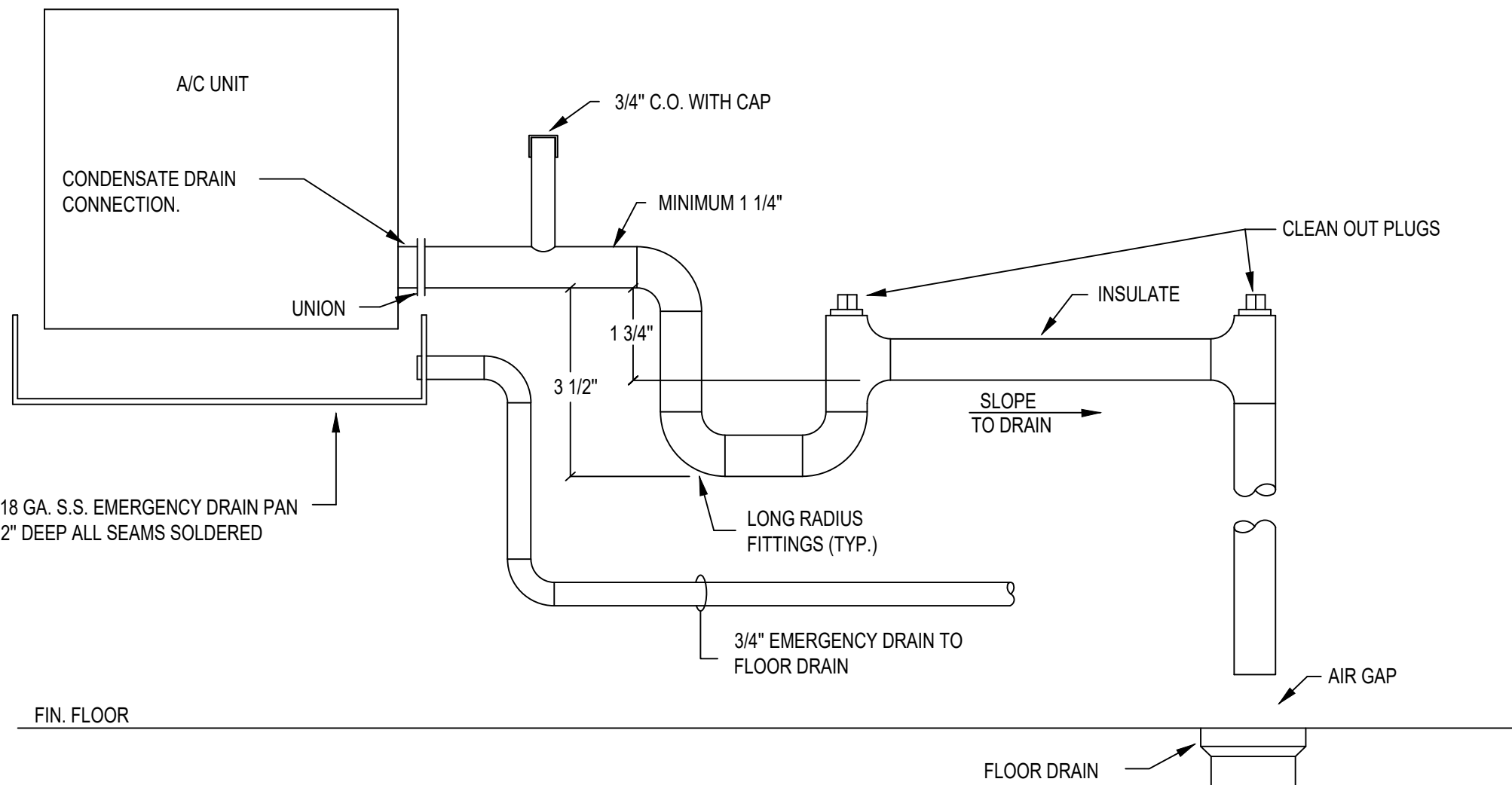
MULTIPLE COIL CONNECTION DETAIL (TYPICAL HEATING AND COOLING)
PROVIDE CONNECTIONS FOR NUMBER OF COILS REQUIRED IN AIR UNIT. 2-COIL UNIT DETAIL SHOWN. VERIFY WITH AIR UNIT MANUFACTURER THE NUMBER OF COILS AND PROVIDE ADDITIONAL CONNECTIONS AS NECESSARY.



TYPICAL AIR UNIT CONNECTION DETAIL
NO SCALE

NOTES:

- PROVIDE DUCT MOUNTED THERMOMETER IN SUPPLY DUCT, WEKSLER MODEL 2R08 WITH 8" STEM, 25°F TO 125°F RANGE, RE CALIBRATION FEATURE.
- INSULATE FIRST 5' OF SUPPLY DUCT WITH 1" INTERNAL LINER IN ADDITION TO EXTERNAL WRAP FOR ACOUSTIC REASONS.
- ALLOW MINIMUM 3'-0" CLEARANCE TO PIPING AND ACCESS DOORS.
- PROVIDE UV LAMPS INSIDE AIR UNIT. SEE SPECIFICATIONS.
- PROVIDE DUCT DETECTOR AND SAMPLING TUBE IN SUPPLY AIR CONNECT TO BUILDING FIRE ALARM SYSTEM.



A/C UNIT CONDENSATE DRAIN DETAIL (DRAW-THRU)
NO SCALE

AIR					HANDLING																								UNIT																SCHEDULE					
MARK	DEMOUNT SIZE NOT TO EXCEED OPENING	LOCATION	CFM	O/A CFM	EXT. S.P. IN W.C.	PRE - HEAT												COIL												RE - HEAT												MOTOR				DATA				DESCRIPTION
						ENT AIR °F				LVG AIR °F				MBTUH	GPM	ENT. WATER °F	LVG WATER °F	MIN ROWS	MAX FINS	AIR P D IN. W.C.	WATER P D FT. H ₂ O	ENT AIR °F				LVG AIR °F				MBTUH	GPM	ENT. WATER °F	LVG WATER °F	MIN ROWS	MAX FINS	AIR P D IN. W.C.	WATER P D FT. H ₂ O	H.P.	VOLTS	PHASE	FAN TYPE									
						DB	WB	DB	WB	DB	WB	DB	WB									DB	WB	DB	WB																									
AHU 3-1	EXISTING LOUVER	3RD FLOOR	40000	40000	3.5	25	-	50	-	1543	122	180	160	1	8	0.07	4.41	95	80	54.0	53.9	294	541	45	58	8	8	0.79	9.0	-	-	-	-	-	-	-	-	60	460	3	PF	HORIZONTAL DRAW THRU AIR HANDLING UNIT WITH HORIZONTAL DISCHARGE. CONFIGURATION SHALL BE FLAT FILTER SECTION (2" 30" AND 4" 60"), PRE-HEAT COIL, COOLING COIL, FAN SECTION WITH FRONT DISCHARGE.								

- NOTES:
- ALL MOTORS TO BE PREMIUM EFFICIENT.
 - UNIT SHALL DEMOUNT TO FIT THRU EXISTING OPENINGS. VERIFY ON SITE.
 - PROVIDE ACCESS DOORS TO ALL SECTIONS. VERIFY LOCATION OF ACCESS DOORS AND PIPING CONNECTIONS WITH DRAWINGS.
 - ACCEPTABLE MODELS: ENERGY LABS, TEMTROL.
 - TEMTROL IS THE BASIS OF DESIGN.
 - PROVIDE UV LIGHTS. SEE SPECIFICATIONS.
 - UNIT SIZE SHALL NOT EXCEED 184"L X 134"W X 124"H. BOTTOM OF SUPPLY OPENING SHALL BE A MINIMUM 84" AFF.

SCHEDULES & DETAILS
NO SCALE



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PROJ. #:

date

16 JUL. 2021

sheet

ME5

1. TEST ALL EXHAUST FANS AND FUMEHOODS SHOWN ON SHEET ME-1 THRU ME-3.
2. VERIFY THE OPERATION OF ALL CONTROLS FOR THE EXHAUST FANS AND HOODS.
3. VERIFY THE AIRFLOW OF ALL EXHAUST FANS AND HOODS.
4. VERIFY THE OPERATION AND AIRFLOW OF ALL GENERAL EXHAUST AND SUPPLY VALVES FOR THE LAB TYPES SHOWN ON SHEETS ME-1 AND ME-2.
5. PROVIDE A REPORT WITH THE STATUS OF CONTROLS FOR EACH LAB AIR SYSTEM INCLUDING THE HOODS, SUPPLY VALVES, GENERAL EXHAUST, AND THE LAB EXHAUST FANS.
6. SEE THIS SHEET FOR THE EXISTING DESIGN SEQUENCES OF OPERATION FOR ALL LAB SYSTEMS. THIS SHALL BE USED AS THE BASIS OF TESTING FOR THE LAB SYSTEMS.

FUME HOODS

EACH LAB IS PROVIDED WITH A CONTROL PANEL THAT IS INTERFACED WITH THE MAIN BUILDING CONTROL PANEL AND THE CCAS. ALL SETPOINTS ARE ADJUSTABLE, ALL INPUTS, OUTPUTS, AND ALARMS ARE MONITORED BY BOTH THE MAIN BUILDING CONTROL PANEL AND THE CCAS. HOOD EXHAUST DAMPER MAINTAIN A CONSTANT HOOD FACE VELOCITY OF 100 FPM, AS SENSED BY THE SASH POSITION OR THERMAL ANEMOMETER DP SENSOR. THE LAB CONTROL PANEL SUMS THE HOOD AND GENERAL ROOM EXHAUST CFM QUANTITIES AND POSITION THE SUPPLY AIR DAMPER TO MAINTAIN A CFM AIR QUANTITY OFFSET BY A FIXED DIFFERENTIAL, RELATIVE TO THE SUM OF THE EXHAUST AIR QUANTITIES. THE ROOM TEMPERATURE IS MONITORED BY A TEMPERATURE SENSING DEVICE. THE SUPPLY AIR DAMPER IS ADJUSTED TO MAINTAIN THE ROOM TEMPERATURE AT A SETPOINT. THE SUPPLY AIR DAMPER MODULATES OPEN TO THE GENERAL EXHAUST DAMPER ALSO MODULATES OPEN TO A POSITION TO MAINTAIN THE CFM DIFFERENTIAL BETWEEN THE LAB SUPPLY AND TOTAL EXHAUST. ON A DEMAND FOR HEATING, THE SUPPLY AIR DAMPER MODULATES TO ITS MINIMUM POSITION, THE GENERAL EXHAUST DAMPER MODULATES TO MAINTAIN THE DIFFERENTIAL, AND THE RE-HEAT VALVE MODULATES TO SATISFY THE SETPOINT.

SUPPLY AIR DAMPER: 210-2310 CFM, 0.60" W.G. APD.
GENERAL EXHAUST AIR DAMPER: 60-470 CFM, 0.60" W.G. APD.
HOOD EXHAUST AIR DAMPERS (QTY. OF 2): 200-1250 CFM, 0.60" W.G. APD.
RE-HEAT COIL: 43.0 MBH, 4.3 GPM, 4.0 FT. WPD, 0.07" W.G. APD
DIFFERENTIAL: 250 CFM

SUPPLY AIR DAMPER:135-1185 CFM, 0.60" W.G. APD.
GENERAL EXHAUST AIR DAMPER:60-275 CFM, 0.60" W.G. APD.
HOOD EXHAUST AIR DAMPERS (QTY. OF 1):200-1250 CFM, 0.60" W.G. APD.
RE-HEAT COIL:20.0 MBH, 2.0 GPM, 4.0 FT. WPD, 0.07" W.G.
DIFFERENTIAL:125 CFM

SUPPLY AIR DAMPER:1000-3480 CFM, 0.60" W.G. APD.
GENERAL EXHAUST AIR DAMPER:60-720 CFM, 0.60" W.G. APD.
HOOD EXHAUST AIR DAMPERS (QTY. OF 2):300-1900 CFM, 0.60" W.G. APD.
RE-HEAT COIL:63.0 MBH, 6.3 GPM, 4.0 FT. WPD, 0.07" W.G. APD.
DIFFERENTIAL: 380 CFM

SUPPLY AIR DAMPER: 290-1120 CFM, 0.60" W.G. APD.
GENERAL EXHAUST AIR DAMPER: 220-530 CFM, 0.60" W.G. APD.
HOOD EXHAUST AIR DAMPERS (QTY. OF 1): 200-1250 CFM, 0.60" W.G. APD.
RE-HEAT COIL: 22.0 MBH, 2.2 GPM 4.0 FT. WPD, 0.07" W.G. APD.
DIFFERENTIAL: 250 CFM

THE LABS FUNCTION SIMILAR TO THE A, B, D, AND E TYPES, WITH THE EXCEPTION THAT TYPE "F" LAB WHICH HAS (1) VAV HOOD AND (2) CONSTANT VOLUME HOOD. THE CONSTANT VOLUME HOOD IS PROVIDED WITH ITS INDIVIDUAL EXHAUST FAN. THIS FAN IS ENERGIZED OR DE-ENERGIZED FROM THE MAIN BUILDING CONTROL PANEL OR THE COAS. THE OPERATION OF THE EMERGENCY GAS SHUT OFF SYSTEM IS FULLY CLOSED BY THE EMERGENCY STOP SWITCH. WHEN THE OPERATION IS PROVEN BY A DP SENSOR AND AN ALARM INITIATED UPON FAILURE. SHOULD THE CONSTANT VOLUME EXHAUST FAN FAIL OR BE DE-ENERGIZED, THE VAV LAB DAMPERS ARE INDEXED TO A "CV FAN OFF MODE" RANGE. WHEN THE CONSTANT VOLUME EXHAUST FAN IS OPERATING, THE VAV LAB DAMPERS ARE INDEXED TO A "cv fan ON" mode. WHEN THE CONSTANT VOLUME EXHAUST FAN IS OPERATING, THE VAV LAB DAMPERS ARE INDEXED TO A "cv fan ON" mode. THE CONSTANT VOLUME HOOD IS EQUIPPED WITH VALVES WHICH FURNISHES FEED BACK SIGNAL TO THE MAC PANEL FOR PROPER COMPENSATION OF LAB AIR FLOWS IN ON & OFF MODES.

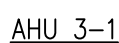
EXISTING EXHAUST FAN SCHEDULE								
E.F. NO.	TYPE	CFM	STATIC PRESS IN. W.G.	H.P.	RPM.	VOLTS	PHASE	REMARKS
E.F. R-1	36" B.I. CENTRIFUGAL, SINGLE WIDTH, BELT DRIVE	27,000	3.25	30.00	1,075 *	460	3	HIGH EFF. TEFC MOTOR WITH WEATHERCOVER ALUMINIUM WHEEL, BAKED PHENOLIC COATED AIRSTREAM; CLASS II CONSTRUCTION.
E.F. R-2	36" B.I. CENTRIFUGAL, SINGLE WIDTH, BELT DRIVE	27,000	3.25	30.00	1,075 *	460	3	HIGH EFF. TEFC MOTOR WITH WEATHERCOVER ALUMINIUM WHEEL, BAKED PHENOLIC COATED AIRSTREAM; CLASS II CONSTRUCTION.
E.F. R-3	30" B.I. CENTRIFUGAL, SINGLE WIDTH, BELT DRIVE	18,000	3.25	20.00	1,300 *	460	3	HIGH EFF. TEFC MOTOR WITH WEATHERCOVER ALUMINIUM WHEEL, BAKED PHENOLIC COATED AIRSTREAM; CLASS II CONSTRUCTION.
E.F. R-4	30" B.I. CENTRIFUGAL, SINGLE WIDTH, BELT DRIVE	18,000	3.25	20.00	1,300 *	460	3	HIGH EFF. TEFC MOTOR WITH WEATHERCOVER ALUMINIUM WHEEL, BAKED PHENOLIC COATED AIRSTREAM; CLASS II CONSTRUCTION.
E.F. R-5	12" B.I. CENTRIFUGAL, SINGLE WIDTH, BELT DRIVE	1,250	0.60	0.33	1,450 *	120	1	WITH BACKDRAFT DAMPER; TEFC MOTOR WITH WEATHERCOVER ALUM. WHEEL, BAKED PHEN. COATED AIRSTREAM; CLASS I CONST.
E.F. R-6	12' B.I. CENTRIFUGAL, SINGLE WIDTH, BELT DRIVE	1,250	0.60	0.33	1,450 *	120	1	WITH BACKDRAFT DAMPER; TEFC MOTOR WITH WEATHERCOVER ALUM. WHEEL, BAKED PHEN. COATED AIRSTREAM; CLASS I CONST.
E.F. R-7	12' B.I. CENTRIFUGAL, SINGLE WIDTH, BELT DRIVE	1,000	1.50	0.50	1,750 *	120	1	WITH BACKDRAFT DAMPER; TEFC MOTOR WITH WEATHERCOVER ALUM. WHEEL, BAKED PHEN. COATED AIRSTREAM; CLASS I CONST.

SUPPLY AIR DAMPER: 210-2310 CFM., 0.60" W.G. APD.
GENERAL EXHAUST AIR DAMPER: 60-690 CFM, 0.60" W.G. APD.
HOOD EXHAUST AIR DAMPER (QTY OF 2): 200-1250 CFM, 0.60" W.G. APD.
RE-HEAT COIL: 43.0 MBH, 4.3 GPM, 4.0 FT WPD, 0.07" W.G. APD.
DIFFERENTIAL: 250 CFM

SUPPLY AIR DAMPER: 125-1060 CFM, 0.60" W.G. APD.
GENERAL EXHAUST AIR DAMPER: 60-175 CFM, 0.60" W.G. APD.
HOOD EXHAUST AIR DAMPERS (QTY. OF 2): 200-1250 CFM, 0.60" W.G. APD.
RE-HEAT COIL: 43.0 MBH, 4.3 GPM, 4.0 FT. WPD, 0.07" W.G. APD
DIFFERENTIAL: 250 CFM

SUPPLY AIR DAMPER: 1260-2310 CFM, 0.60" W.G. APD.
GENERAL EXHAUST AIR DAMPER: 60-690 CFM, 0.60" W.G. APD.
HOOD EXHAUST AIR DAMPERS (QTY. OF 2): 200-1250 CFM, 0.60"W.G. APD.
RE-HEAT COIL: 43.0 MBH, 4.3 GPM, 4.0 FT. WPD, 0.07" W.G. APD
DIFFERENTIAL: 250 CFM

EXHAUST FAN E.X. 7 IS STARTED AND STOPPED VIA THE EXISTING C.C.A.S. NETWORK. WHEN THE OUTSIDE AIR DAMPER IS OPEN AS PROVEN BY AN END SWITCH, THE FAN IS STARTED. WHEN FAN OPERATION IS PROVEN BY A DP SWITCH, THE CONTROL LOOPS ARE ENABLED. THE PLENUM AUTOMATIC DAMPERS ARE MODULATED BY AN ASC TO MAINTAIN STATIC PRESSURE SETPOINT (1.5"WC, ADJUSTABLE) AT THE END OF ITS RESPECTIVE DUCT RUNS. A STATIC PRESSURE SENSOR IS LOCATED AT THE END OF EACH DUCT RUN AND SELECT THE LOWEST STATIC AS THE CONTROL POINT.



THE AHU SHALL BE STARTED AND STOPPED VIA THE EXISTING C.A.S. NETWORK. WHEN THE OUTSIDE AIR DAMPER IS OPEN AS PROVEN BY AN END SWITCH, THE FAN SHALL BE STARTED. WHEN FAN OPERATION IS PROVEN BY A DP SWITCH, THE CONTROL LOOPS SHALL BE ENABLED. AN APPLICATION SPECIFIC CONTROLLER (ASC) SHALL RAMP THE VARIABLE FREQUENCY DRIVE TO MAINTAIN DUCT STATIC PRESSURE SETPOINT (1.5" W.G., ADJUSTABLE) AS SENSED BY A STATIC PRESSURE SENSOR WITH SENSING TIPS LOCATED THE WAY DOWN THE LONGEST DUCT RUN. THE ASC SHALL MODULATE THE PNEUMATIC NORMALLY CLOSED CHILLED WATER AND HOT WATER CONTROL VALVES TO MAINTAIN DISCHARGE AIR SETPOINT. COOLING SETPOINT SHALL BE 55°F AND HEATING SETPOINT SHALL BE 52°F. THE COOLING AND HEATING SETPOINTS ARE THE C.A.S. NETWORK. THE COOLING CONTROL VALVE SHALL BE MODULATED OPEN IN RESPONSE TO SPACE RELATIVE HUMIDITY (DEHUMIDIFICATION) SETPOINT. A LOW LIMIT CAPILLARY TUBE THERMOSTAT SHALL STOP THE AHU AND CAUSE THE CHILLED WATER AND HOT WATER CONTROL VALVES TO OPEN FULLY SHOULD LEAVING AIR TEMPERATURE DROP BELOW 35°F. THE AHU SHALL BE STOPPED UNTIL MANUALLY RESET SHOULD THE DUCT SMOKE DETECTORS SENSE THE PRESENCE OF SMOKE.

THE EXHAUST FANS ARE INTERLOCKED SUCH THAT ONLY ONE FAN PER SET MAY OPERATE AT A TIME. THE FANS ARE ALTERNATED VIA THE C.C.A.S. NETWORK, EITHER VIA MANUAL COMMAND OR TIME SCHEDULE. WHEN A FAN'S OUTSIDE AIR DAMPER IS PROVEN OPEN BY AN END SWITCH, IT IS STARTED. SHOULD A FAN BE COMMANDED "ON" FAIL TO RUN (AS SENSED BY A DP SWITCH), THE OTHER FAN IN THAT SET IS STARTED. TIME DELAY RELAYS ARE INSTALLED AS NECESSARY TO PROTECT THE DUCTWORK AND TO PREVENT CYCLING. THE PLENUM PRESSURE DAMPERS ARE MODIFIED BY AN END SWITCH TO MAINTAIN A SET POINT PRESSURE SETPOINT (1.5" W.C., ADJUSTABLE) AT THE END OF ITS RESPECTIVE DUCT RUNS. A STATIC PRESSURE SENSOR IS LOCATED AT THE END OF EACH DUCT RUN AND SELECT THE LOWEST STATIC AS THE CONTROL POINT.



SCHEDULES & DETAILS
NO SCALE



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Scales stated herein are valid on the original drawings only. Contractor shall carefully review all dimensions and conditions shown and report to the engineer any errors, inconsistencies, or omissions discovered.

These plans were prepared in this office under our personal supervision, and to the best of our knowledge comply with state and local codes. We will generally administer construction,

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